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RADIATION PROTECTION MANAGEMENT ACT OF 1982

HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY, NUCLEAR PROLIFERATION, AND GOVERNMENT PROCESSES

OF THE

COMMITTEE ON GOVERNMENTAL AFFAIRS UNITED STATES SENATE

NINETY-SEVENTH CONGRESS

SECOND SESSION

ON

S. 2284

TO INSURE ADEQUATE PROTECTION OF WORKERS, THE GENERAL PUBLIC, AND THE ENVIRONMENT FROM HARMFUL RADIATION EXPOSURE, TO ESTABLISH MECHANISMS FOR EFFECTIVE COORDINATION AMONG THE VARIOUS FEDERAL AGENCIES INVOLVED IN RADIATION PROTECTION ACTIVITIES, TO DEVELOP A COORDINATED RADIATION RESEARCH PROGRAM, AND FOR OTHER PURPOSES

APRIL 29, 1982

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THURSDAY, APRIL 29, 1982

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RADIATION PROTECTION MANAGEMENT ACT OF 1982

THURSDAY, APRIL 29, 1982

U.S. SENATE,
SUBCOMMITTEE ON ENERGY, NUCLEAR
PROLIFERATION, AND GOVERNMENT PROCESSES,
COMMITTEE ON GOVERNMENTAL AFFAIRS,
Washington, D.C.

The committee met at 9:20 a.m., in room 3302, Dirksen Senate Office Building, Hon. Charles H. Percy (chairman of the subcommittee) presiding.

Present: Senators Percy and Glenn.

OPENING STATEMENT OF SENATOR PERCY

Senator PERCY. This morning the Subcommittee on Energy, Nuclear Proliferation, and Government Processes will hold hearings on S. 2284, the Radiation Protection Management Act of 1982.

We are starting reasonably on time. I am very grateful to have Senator Glenn here to pick up and chair the hearing after I make a few comments.

We regrettably have an overlay in committees. At 9:30, the Secretary of Defense, Secretary Weinberger, will be testifying before the Foreign Relations Committee. I have to chair that hearing on arms control.

Senator Glenn has agreed to chair this hearing.

We will miss you down at the other hearing, but hope you can get there when you can.

The effects of radiation touch all of us, from a simple X-ray at a dentist's office to the persistent and variable effects of natural background radiation.

Scientists over the last decade have made tremendous progress in discovering the risks that exposure to radiation holds. While it is difficult today to tell what, if anything, constitutes a safe level of radiation exposure, we do know that radiation can be a health risk to people. At this point we just need to know more about this common, complex, and sometimes dangerous phenomenon.

I wish to compliment my colleague, John Glenn, for bringing this issue to public attention by introducing the Radiation Protection Act of 1982. This bill would establish two Federal groups to coordinate the Government's efforts in radiation protection and research culminating in a reorganization of Federal radiation protection activities by the late 1980's.

As a general matter, I think we should be very careful about setting up new Federal entities as a response to policy problems. Too often in the past we have chosen to establish, organize, and reorganize instead of taking a hard look at why our present Federal agencies are not doing the job they should.

We would all be better off with less layers of bureaucracy between the people and the problem. On the other hand, I know that the Federal Government sometimes needs a legislative initiative to insure better coordination among its different parts.

As Senator Glenn has said, there are over 20 different agencies involved in radiation protection and research.

I understand that the Federal Coordinating Council for Science, Engineering, and Technology, chaired by the President's Science Adviser, Dr. Keyworth, is looking into this problem right now. They enthusiastically support Senator Glenn's contention that better coordination is needed in the radiation protection area. It may be the Reagan administration can solve this problem by executive action, making this bill unnecessary. If so, the credit should go and will go to Senator Glenn, who is the first to give this issue the attention that it really deserves.

While I now must leave this hearing, I look forward to reading the record of today's hearing to learn more about the problem of radiation protection and how the Government might better organize its efforts in this area.

Now, I would like to turn the hearing over to Senator Glenn.

OPENING STATEMENT OF SENATOR GLENN

Senator GLENN [presiding]. Thank you very much, Mr. Chairman. I thank you for convening this hearing because of my interest and I know of your own deep interest in the subject, in health and safety matters in general.

I am glad we are able to work together closely to hopefully plug this gap that exists right now because too many States have no regulation whatsoever over these matters. It is something that has come to the front over a lengthy period of time.

I am sure you will recall, 3 years ago, we had hearings on this. I chaired the hearings at that time. There were horror lists of lack of regulation in this area and of spot checks of machines and equipment in different places. It showed them to be completely out of tolerance, giving people severe overdoses of radiation on occasion. It is something that is not a small item, but is a spreading problem as more and more of these items come into common use.

Radiation-emitting materials or devices, including radioisotopes for medical diagnoses and therapy, CAT scanners and other diagnostic aids involving X-rays as well as nuclear materials and equipment for generation of electricity.

The issue of the Federal role in radiation protection was reviewed in hearings 3 years ago and they confirmed the widely held view that the Federal programs in these areas were in disarray with only scattered and confused regulatory and research responsibilities spread through more than 20 Federal agencies, as the chairman already mentioned.

Although the previous administration attempted to come to grips with this problem by establishing through a Presidential Executive order two coordinating bodies to mitigate the jurisdictional fragmentation in regulation and research, the results thus far have been disappointing.

Indeed, the Reagan administration last year zeroed out funds for one of those coordinating bodies, the Radiation Policy Council. That action basically returned us to the situation that existed in 1970, a situation that ultimately was deemed unsatisfactory by most people, including those who served on the White House Task Force on Ionizing Radiation formed in 1978.

That task force was formed to make recommendations across a wide spectrum of radiation protection activities and they very strongly endorsed organizational change.

Last year, the National Academy of Sciences Committee on Federal Research on the Biological and Health Effects of Ionizing Radiation, the FREIR Committee, issued a report reviewing and evaluating the scope and quality of research on the biological and health effect of ionizing radiation, supported or conducted by agencies of the Federal Government.

The FREIR Committee assessed not only the relevant research programs themselves, but also evaluated the management practices used by the Federal Government to support those programs. The report states in part:

> The recent history of Federal involvement in ionizing radiation research and regulation activities is characterized by an increasing dispersal of managerial authority. Today there are literally dozens of agencies that can legitimately claim a voice in the formulation of policy pertaining to one or more aspects of ionizing radiation. Where once there was an extraordinary degree of centralization and managerial authority, there is now an extreme degree of jurisdictional fragmentation. It is doubtful that any other program area in Government has been subjected to such a marked change in jurisdictional alignment in as short a time.

The FREIR Committee, as the White House task force before it, also recommended organizational change, the formation of an interagency coordinating body to deal with the regulation of radiation sources and research on the effects of radiation.

I am convinced that organizational change and coordination among agencies is essential to deal with our present chaotic situation. The demise of the old Federal Radiation Council in 1970, despite the transfer of some of its authorities to EPA, has resulted in a serious erosion of interagency coordination in the area of radiation protection. Americans are still receiving excessive radiation, mostly through diagnostic medical procedures. We must increase our attention to issues such as the overuse of medical X-rays, the licensing and inspection of all radiological equipment, the undertraining of radiological personnel, the licensing of institutions providing such training, the use of radioactive materials in consumer products, the validity of current radiation dose limitations for persons in certain occupations and the adequacy of the public education program regarding radiation protection.

The bill that is the subject of today's hearing, S. 2284, in my view, will significantly improve the organization of the Federal Government's efforts in radiation research and protection. It sets up two coordinating bodies, one dealing with radiation protection and the other

with radiation research, that bring together the many Federal departments and agencies involved in these matters.

Under the bill, the Federal Council on Radiation Protection would provide advice and guidance on radiation protection standards, review the various agencies' authorities over radiation-related matters, and recommend any necessary changes in those authorities. It would also help identify agencies' research needs in this area, help develop public education programs on radiation health and safety and review State and local radiation control programs. It would submit periodic reports and recommendations dealing with Federal radiation protection activities.

The other coordinating body set up by the bill, the Federal Conference on Research into the Biological Effects of Radiation, would advise on the development of radiation research projects, issue an annual comprehensive Federal agenda on radiation health effects research, make various recommendations regarding the conduct of that research and the dissemination of its results, and assist in the development of public education programs.

It would also review agency radiation research requests according to several criteria in order to decide whether each proposed project has scientific merit and, if so, whether the requesting agency is the right group to do it.

With respect to the issue of research, I note that the National Academy of Sciences FREIR Committee indicated the importance of a Federal Government commitment to long-term support for studies on the effects of ionizing radiation, but that agencies are reluctant to allocate their limited resources to long-term commitments. The FREIR report says:

> The committee believes that it is imperative that the proposed inter-agency coordinating committee ensure that sufficient resources be set aside either by individual agencies or several agencies through sharing agreements to provide the support required for continuing projects in this field.

In other words, the FREIR Committee is suggesting that stable and predictable funding be made available for long-term studies in this area, a recommendation that I wholeheartedly agree with, not only in this area, but for basic scientific research in general.

There are other issues I would like to address, but I will reserve further comment until the question period.

I might say, the FREIR Committee report, on Federal research on the biological health effects of ionizing radiation, is quite a report, a complete report. They did a tremendous amount of background work on this. It is not just a small sketchy report as some of our committees turn out. It is a very complete and thorough report and I agree with most of the conclusions that they came to.

With that, we have three different groups before us this morning to comment on the proposed legislation.

The witness list includes Mr. J. Dexter Peach, Director, Energy and Minerals Division, U.S. General Accounting Office. He will appear by himself. Then we will have a panel that will include Dr. Edward N. Brandt, Assistant Secretary for Health, Department of Health and Human Services, who is accompanied by Dr. David E. Patterson, Director, Operational Safety Office of the Deputy Assistant Secretary

for Environment, Safety, and Health of the Department of Energy; Mr. Gordon Burley, Director, Office of Radiation Programs, Environmental Protection Agency; Lt. Col. Carl N. Stroud, Office of Biomedical Adviser, Defense Nuclear Agency, Department of Defense, and a representative of the Veterans' Administration.

Also on the panel will be Mr. Robert B. Minogue, Director, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission. The next panel will consist of Warren K. Sinclair, president, National Council on Radiation Protection and Measurement; Mr. Hayward Shealy, chief, Bureau of Radiological Health, South Carolina Department of Health and Environmental Control; Mr. Robert Alvarez, Environmental Policy Center; and Mr. Lionel Lewis of Duke Power Co., Atomic Industrial Forum representative.

Mr. Peach, we will be glad to have you come forward, please.

TESTIMONY OF J. DEXTER PEACH, DIRECTOR, ENERGY AND MINERALS DIVISION, GENERAL ACCOUNTING OFFICE, ACCOMPANIED BY JOHN HARMAN, GROUP DIRECTOR, EMD; JIM SHAFER, EVALUATOR-IN-CHARGE, WASHINGTON REGIONAL OFFICE; AND BRUCE CHAFIN, STAFF EVALUATOR, WASHINGTON REGIONAL OFFICE

Mr. PEACH. Mr. Chairman, let me start this morning by introducing my colleagues with me at the table.

Starting at my left, I have two gentlemen that have been involved in radiation protection coordination we have been doing at your request, Mr. Bruce Chafin, who is from our Washington Regional Office, and Mr. James Shafer, with our Washington Regional Office.

On my right I have John Harman, who is Group Director for the nuclear-related work we do.

We appreciate this opportunity to present our views on S. 2234, which would establish a Federal Council on Radiation Protection and a Federal Conference on Research Into the Biological Effects of Radiation. At the subcommittee's request, we have recently reviewed the need for more effective coordination and radiation protection in research programs.

Currently, there are at least 17 agencies involved in various aspects of radiation protection and 16 agencies involved in radiation research. This fragmentation of responsibilities led to concerns about the adequacy and effectiveness of Federal programs in these areas.

In the late 1970's, GAO and other organizations issued several reports identifying major weaknesses in radiation protection and research efforts. These reports identified a need for interagency coordination to provide up-to-date standards and broad policy leadership. In recognition of these problems, President Carter, in early 1980, established a Radiation Policy Council and an Interagency Radiation Research Committee.

The Policy Council, composed of senior representatives from various agencies responsible for radiation protection, was to (1) serve as a forum for interagency communication and (2) coordinate the development and implementation of Federal radiation protection policies

and standards. It only functioned for 6 months, however, before its funding was eliminated as part of budget changes made by the incoming Reagan administration. More importantly, the Council, in the view of some of its members, only had a limited chance of success. First, it was chaired by the Environmental Protection Agency, which placed a low priority on radiation policy issues. Second, the Council did not have the authority to set radiation standards. Thus, it was primarily a study group responsible for making recommendations. The bill under consideration by this subcommittee today overcomes these shortcomings and appears to be a viable option for improving interagency coordination and expediting the development of radiation standards.

The Interagency Radiation Research Committee, on the other hand, has apparently been functioning well since its inception. Given the proper support from its member agencies, the committee is attempting to coordinate and add focus to the various Federal radiation research programs.

Let me turn to some specifics on the Federal Council on Radiation Protection.

Prior to the creation of the Radiation Policy Council, the lack of formal coordination among the many Federal and State agencies involved in radiation protection created inconsistencies and gaps in radiation protection policies and standards and hindered implementation and enforcement of radiation protection programs. The Radiation Policy Council, however, because of its short lifespan and lack of standards setting authority, did little to improve these deficiencies. Nevertheless, it established a framework for coordination and cooperation which could be workable if certain changes were made.

Probably the biggest change to be made, which is addressed in the bill under consideration today, is providing the Council with the responsibility to develop and submit radiation standards for Presidential approval. Over the past 12 years, this responsibility has belonged to EPA. Yet, during this time, EPA has only issued one set of radiation standards which was on the diagnostic use of X-rays. As a result, some standards are either out of date or have not yet been developed. This has forced other agencies to unilaterally develop regulations to implement their radiation protection programs. Unfortunately, without the overall guidance from EPA, these regulations sometimes vary from agency to agency and are subject to revision when or if standards are later developed.

For instance, in an ongoing review we found that EPA has not yet developed the necessary radiological standards to guide the decontamination and decommissioning of retired nuclear facilities. This has delayed decommissioning efforts, may increase decommissioning costs, and has prevented the determination of disposal capacity needs for radioactive waste from decommissioning activities. In addition, when final standards are issued, additional decommissioning work may be necessary at those sites and facilities which have already been cleaned up. We expect to issue a report on this subject in about 1 month.

In 1978, we reported that this type of inaction was due to the low priority EPA placed on radiation protection, staffing and funding restrictions within EPA, limited cooperation from other agencies,

and jurisdictional challenges to EPA's authority. This situation apparently has not changed. For example, in January 1981, after 7 years of effort, EPA released proposed occupational exposure standards for agency and public comment. The general response has been so negative that the standards have not been officially issued. Criticism centers around the proposal's departure from internationally accepted standards and the additional expense these standards will cause without substantially improving radiation protection.

As a result of EPA's inability to develop these standards, the Nuclear Regulatory Commission is independently revising its occupational exposure regulations. When implemented, these regulations may no longer be consistent with those of other Federal agencies, such as the Occupational Safety and Health Administration. This will require OSHA and the other agencies to either follow the NRC changes or continue to operate under their own existing, but different, regulations. It could also force States to choose between the regulations of two Federal agencies. For example, OSHA has occupational exposure agreements with 24 States, some of which have similar agreements with NRC. Currently these agreements are compatible. If NRC changes its regulations, however, NRC agreement States could be regulating under different rules than OSHA agreement States, and the States having agreements with both OSHA and NRC would be forced to choose between the two. This type of inconsistency can undermine confidence in Federal radiation protection efforts.

On the other hand, there is evidence that an interagency body, such as the Radiation Policy Council, could improve the coordination among Federal agencies and reduce the time frames associated with standards development. In one particular instance, NRC used the Radiation Policy Council forum to solidify support for a change in its low-level waste disposal regulations.

This change will save NRC licensees an estimated $13 million annually and conserve low-level waste burial capacity that is already in short supply. While it is possible that this change would have occurred without the support of the Radiation Policy Council, NRC officials said the Council greatly facilitated their efforts.

We believe, therefore, that a Federal Council on Radiation Protection, as envisioned in S. 2284, would be beneficial in coordinating and establishing radiation protection guidelines and standards. Its most important feature, we feel, is that all Federal agencies with radiation protection responsibilities or programs would have a voice in setting radiation standards. This should help increase the emphasis and priority assigned to this task.

The proposed bill calls for funding the Council's activities. However, this may not cause any increase in total Federal outlays and, in fact, might actually save the Government money. Funding needs could be minimized by drawing financial and staffing support from the existing budgets of each of its member Federal agencies. In fact, these agencies already provide staff support through ad hoc committees formed by EPA to obtain agency input on proposed radiation policy standards. In addition, each agency already has radiation-related programs and should be able to accommodate the costs of the Council's activities without substantially affecting their ongoing efforts.

When considering the cost impact of this Council, it is also important to weigh the potential programmatic benefits associated with the development of consistent and timely radiation policies and standards. For instance, DOE is currently charged with cleaning up abandoned uranium mill tailing sites under an arrangement where the Federal Government will pay 90 percent of the cleanup costs. EPA's failure to develop radiation standards has delayed DOE's implementation and contributed to huge cost increases of that program. Had DOE been a member of a standards-setting policy council it may have been able to encourage development of these standards in a more timely manner.

Several alternatives to an interagency policy council are available for developing Federal radiation protection policies and standards. One alternative is to leave these responsibilities with EPA. Clearly, this would require a major recommitment by EPA to assign higher priorities to radiation protection issues and to insure that radiation standards are formulated in an efficient and timely manner.

In this respect, our report on the problems associated with decontaminating and decommissioning nuclear facilities, which we expect to issue in about 1 month, will deal extensively with EPA's inability to promulgate radiation standards. We believe that EPA should submit to Congress specific time frames for developing these standards. If congressional oversight committees are dissatisfied with these time frames or EPA's commitment to radiation issues, we believe that Congress should transfer the radiation standards setting authority to another agency or group. We feel strongly that EPA has had ample opportunity to meet its radiation protection responsibilities. Further delays or lack of commitment should no longer be accepted.

If Congress decides to transfer this responsibility, a Federal Council on Radiation Protection is clearly a viable alternative. As I have already mentioned, this Council could greatly improve the interagency cooperation and emphasis on radiation policies and standards. Yet, if properly structured, the Council could draw on the resources of its member agencies and not involve any increase in budget outlays.

I would caution, however, that councils or commissions have not always been the most efficient mechanism for making decisions. For that reason, we support provisions which would require the Council to keep congressional committees fully informed of its activities and require a congressional reevaluation of the Council at some future date before deciding to extend its authority and responsibilities. Provisions similar to these are in S. 2084.

Other alternatives would be to transfer the policy and standards setting responsibilities to another lead agency—such as NRC or the Department of Health and Human Services—or keep the standards setting responsibilities in EPA but transfer policy responsibilities to the Office of Science and Technology Policy in the Executive Office of the President. This latter alternative has been proposed by the Office of Management and Budget. Neither of these alternatives, however, may be as preferable, in our view, as the interagency policy council approach.

Specifically, the lead agency approach may have some disadvantages similar to those that currently exist at EPA. For example: Other reg-

ulatory and user agencies must rely on the priority placed on this issue by the lead agency; policy recommendations might be overly influenced by the interests of the lead agency; and the lead agency approach does not insure a mechanism for resolving differences among agencies or a forum for agencies to exchange information.

The transfer of the policy responsibilities from EPA to the Office of Science and Technology Policy is the least preferable alternative in our view. Its major disadvantage is that it separates the policy-making from the standards setting authority. This separation was a primary reason for the failure of the Radiation Policy Council and may not improve the Federal Government's ability to develop protection standards. In addition, there is no assurance that the Office of Science and Technology Policy will place any more emphasis on radiation protection issues than EPA has placed in the past.

Turning to the Radiation Research Committee briefly, in contrast to the former Radiation Policy Council, the Interagency Radiation Committee has been functioning well. Research into the biological effects of ionizing radiation has been federally supported for the past half century, primarily by the Department of Energy and its predecessors, the Energy Research and Development Administration and the Atomic Energy Commission. Since the late 1960's, the number of Federal agencies involved in or supporting radiation research has increased. As this participation has increased, the potential for inappropriate duplication or gaps to occur in their research also increased, necessitating a need for more interagency coordination. In early 1980, President Carter, acting on the recommendation of the Interagency Task Force on the Health Effects of Ionizing Radiation, directed the creation of the Interagency Radiation Research Committee composed of representatives from the various agencies involved in radiation research.

The committee has developed and issued a strategy document for ionizing radiation research and is working toward establishing: procedures for the periodic in-depth technical review of Federal radiation research programs; procedures to insure that the research needs of the Federal agencies are met; and uniform review guidelines, in order to achieve a standard of high quality of research conducted or supported by each Federal agency.

We believe this progress demonstrates that the committee has served as a constructive forum for improving the overall quality of the Federal support of ionizing radiation research. S. 2284 will make this a statutory body and guarantee continued efforts toward establishing a comprehensive radiation research program.

It might be useful to recognize at this point, Mr. Chairman, that in a report we issued in 1981 on the health effect of low level ionizing radiation, we recommended that an interagency policy council, which had been recently created by the President by executive memorandum, should be a statutory body. This, we felt, would provide additional prestige and emphasis to the responsibilities of the council and improve the relationship that would exist with respect to reporting back and keeping the President advised as to what was going on.

In summary, Mr. Chairman, our work has shown that an interagency council is a viable approach to improving interagency co-

ordination and insuring timely development of radiation policies and standards. Therefore, if Congress decides to transfer EPA's responsibility in this area, we would support that transfer to a group such as envisioned in S. 2284. This kind of approach has apparently been working well in coordinating Federal radiation research efforts. We, therefore, also support the provisions of S. 2284 making the Interagency Radiation Research Committee a statutory body.

However, there are some specific changes we would propose to the bill. These are included in the attachment to this testimony and deal with the functions of the proposed council and the specific wording in the sunset provisions of the bill.

That concludes my formal statement, Mr. Chairman. I and my colleagues will be pleased to respond to your questions.

Senator GLENN. Thank you very much, Mr. Peach.

It is an excellent statement.

I might say as far as EPA's functions, which you are very critical of, we originally started out on this legislation wanting to keep EPA more in the loop here in their lead status. We have been unable to get information, we can't even get a reply to my letter of last November 12. We had a couple inquiries about that. I sent a letter November 12 to the Administrator of EPA citing the Executive order that was still in effect on the Radiation Policy Council and reiterating that the Council was to coordinate the formulation and implementation of Federal policy and was to transmit an annual report of its activities to the President and to the heads of the agencies represented on the Council on or before September 30 of each year. In my letter, I wrote:

> It is my understanding that no report has thus far been issued by the Council during 1981.
>
> I would like to know what the status of the report is and the expected date of public release. Also, it is my understanding that the Radiation Council sponsored a workshop on radiation and I would like to receive a copy of the report of the workshop as well.
>
> Finally, because of the reorganizations at EPA and other agencies, it is no longer clear to me as to what the status of EPA's activities in radiation protection are at this time. I would appreciate if your office could arrange for a briefing to be given to Dr. Weiss,

Who is here with me this morning—

> and my subcommittee staff, concerning the radiation protection activities of EPA since the advent of the Reagan administration.

Et cetera.

We checked, the letter did get there, although we have yet to receive an acknolwedgment of the letter. The telephone calls we made to find out when we are going to get the required report resulted in nothing.

So, partly, as a result of that, we decided EPA's interest in this area is obviously low enough that in this bill we wrote in another agency to chair the Federal Council. I know Mr. Burley is representing EPA and I hope he can make some comment on this as to what the situation is.

Mr. PEACH. Mr. Chairman, I might offer a couple of observations on that.

One of the things we did was conduct intensive interviews with the various people that have been involved in the Radiation Policy Council. The general view that we got is that radiation policies and standards had been given very low priority and was of little interest to EPA.

Obviously if the Chair on the Council has little interest in making it work effectively, it will not work effectively. I think it is probably useful to take a look at some of the information that we have which shows that the only area in which EPA has set standards is in the X-ray area.

Looking at mill tailings, EPA is talking about perhaps getting mill tailings standards out in 1983. Those were legislated and mandated in 1979 and again in 1980 to help DOE carry out its mill tailings cleanup program. DOE has been delaying that program. Its original estimated cost was from $80 to $120 million. Now they are looking at a price tag approaching $600 million or more for the cleanup. So you have some costs involved in delay and lack of certainty about these standards. In other areas such as high level waste, we are looking at a 1984 time frame for standard development. In a particular review we did on decommissioning and decontaminating nuclear facilities, we found that standards are not expected until 1986. Nevertheless, certain facilities are already being decommissioned with the uncertainty as to whether it is being done in accordance with standards.

Senator GLENN. You issued a report out of GAO December 4, 1979, entitled "Radiation Control Programs Provide Limited Protection," and in that GAO study of State radiation protection programs, the GAO said that the States inspected only about 34,000 of the estimated 138,000 medical X-ray machines in use during fiscal 1979. The U.S. Bureau of Radiological Health reported that 25 percent of the machines that were inspected were found to be not in compliance with even State regulations or recommendations. Is the GAO planning an update of this study and can you tell me whether you have any information as to whether any improvement has been made since your report of 1979?

Mr. PEACH. I do not know that we have done a specific followup of that study. That particular study was carried out by one of our sister divisions in GAO, our Human Resources Division, and we did testify before the Senate Energy and Natural Resources Committee on that.

You are correct in the information you present about the problems we found. We will provide information to your staff as to whether there are any specific plans for a followup on that.

Senator GLENN. I want to repeat those figures again because I think they are very important. GAO in that 1979 report said that the States inspected only 34,000 of the 138,000 machines in use during 1979 and 25 percent of the machines were found to be outside limitations. Think of the health hazard that causes. Get a dental X-ray, chest X-ray, whatever kind of machine is being used, you have got a 1-in-4 chance that it is being given to you outside the normal dosages that machine was set up to give. That was only a check of 34,000 of the estimated 138,000.

About 3 years ago, there was an article in the Washington Post which revealed at that time only 10 States required licensing of X-ray technicians. Has that situation improved as far as you know?

Mr. PEACH. There are still a number of States that do not require licensing. I think it has improved beyond that number, although I do not have the specific number.

Senator GLENN. This was 3 years ago, and the only States at that time that required X-ray technicians to even have a license were California, New York, New Jersey, Delaware, Oregon, Hawaii, Arizona,

Montana, Kentucky, and West Virginia. And only California required all persons who give X-rays, whether technicians or doctors, to pass a State examination. I think we are grossly negligent——

Mr. PEACH. It might be useful to place on the record, there was also work that was done by the GAO that dates back to 1976, and it looks at this particular X-ray area. The recommendations in that report suggested that the Secretary of HEW should take a great deal more interest in achieving adequate accreditation programs with States dealing with areas of X-ray technicians and X-ray machines.

Senator GLENN. I hate to use my home State of Ohio as an example, but there was a report in this Columbus Dispatch that the Radiological Health Director, Robert Quillan, in Ohio, says that the 16,000 X-ray machines which are contained in the State's registration reports may be inspected only once every 10 or 12 years. In addition there may be thousands of unregistered machines.

We are not even sure all are registered. There are only six inspectors in the Office of Radiological Health Director. That sounds like a pretty serious situation to me.

Would you think that our situation, which I just outlined in Ohio, is more typical than abnormal across this country?

Mr. PEACH. I suspect it is probably more typical. We have not done specific work in that area. If you go back to the work we did in 1976 and again in 1979, it shows a lot of deficiencies in that area.

It shows a lot of States that have little, if any, regulation in that area.

Senator GLENN. Thank you, Mr. Peach. We have other witnesses, unless you have some of the other gentlemen with you who want to make some comment here?

Do any of the other gentlemen want to make a comment?

Mr. PEACH. They were the people who developed the statement and they feel they covered the issues they saw there pretty well.

Thank you.

[A supplement to Mr. Peach's testimony follows:]

SUGGESTED CHANGES TO S. 2284

There are two provisions of S. 2284 which the Congress may wish to consider changing. First, Section 102(a)(5) and (6) directs the Federal Council on Radiation Protection to develop and recommend programs to educate the public concerning radiation health and safety and to review State and local radiation control programs. We believe that the proper role of the Council should be to coordinate these activities among other responsible Federal agencies—not to directly perform them. Therefore, we suggest a change in this area and in Section 202(a)(4) which requires the Federal Council on Radiation Protection to assist the Council in its proposed public education programs. We suggest that section 102(a) be changed to read as follows.

"The Council shall * * * (5) review programs of any Federal agency to educate the public concerning radiation health and safety and recommend to the agency any amendments or modifications to the program; (6) review the monitoring by Federal agencies of state and local radiation control programs and recommend to the agency any amendments or modifications to the monitoring process."

Second, Section 108 requires the automatic termination of the Council and Section 206 requires termination of the Conference when the President submits a reorganization plan to Congress "which transfers the functions of the Council (Conference) to other Federal agencies." We suggest rewording of these sections to make it clearer to recognize that the Council and the Conference could continue to exist if the Congress so chooses. As now worded, the bill appears to

mandate termination of the Council regardless of its success or need for continuation. We suggest that Section 108 be changed to read as follows.

SECTION 108

"(b) (1) Not later than July 31, 1988, the President shall prepare and transmit to the Congress a reorganization plan in accordance with the provisions of chapter 9 of title 5, United States Code, which transfers the functions of the Council to other Federal agencies.

(2) If either House determines that the Council should continue to exist, either House may pass a reolution, in accordance with section 906 of such title, stating in substance that the House does not favor the reorganization plan.

(3) Should the reorganization plan transmitted to the Congress under paragraph (1) be disapproved, the Council and its authorities under this Act shall continue in effect until modified, amended, or terminated by Act of Congress."

Similarly, we suggest that Section 206 be changed to read as follows.

SECTION 206

"(b) (1) Not later than July 31, 1988, the President shall prepare and transmit to the Congress a reorganization plan in accordance with the provisions of chapter 9 of title 5, United States Code, which transfers the functions of the Conference to other Federal agencies.

(2) If either House determines that the Conference should continue to exist, either House may pass a resolution, in accordance with section 906 of such title, stating in substance that the House does not favor the reorganization plan.

(3) Should the reorganization plan transmitted to the Congress under paragraph (1) be disapproved, the Conference and its authorities under this Act shall continue in effect until modified, amended, or terminated by Act of Congress."

Senator GLENN. Could we have the second panel of administration witnesses, Dr. Robert Brandt, Dr. David Patterson, Gordon Burley, and Lt. Col. Carl Stroud.

There was supposed to be a representative of the Veterans' Administration here. Is he or she here? I do not have a name. I understood they would have a representative here.

Gentlemen, I am going to have you wait just a little bit here. We do have a vote on. I think while we are at a breaking point now, I will vote, run over to the floor and back so there will be a slight delay.

[Brief recess.]

Senator GLENN. The hearing will be in order.

I am told I omitted Robert B. Minogue when I called the people to the table. I am sorry for that omission. Glad to have you.

Dr. Brandt, do you have any statement you wish to make?

TESTIMONY OF EDWARD N. BRANDT, JR., M.D., ASSISTANT SECRETARY FOR HEALTH, DEPARTMENT OF HEALTH AND HUMAN SERVICES; DAVID E. PATTERSON, DIRECTOR, OPERATIONAL SAFETY OFFICE OF DEPUTY ASSISTANT SECRETARY FOR ENVIRONMENT, SAFETY, AND HEALTH, DEPARTMENT OF ENERGY; GORDON BURLEY, DIRECTOR, OFFICE OF RADIATION PROGRAMS, ENVIRONMENTAL PROTECTION AGENCY; LT. COL. CARL M. STROUD, OFFICE OF BIOMEDICAL ADVISER, DEFENSE NUCLEAR AGENCY, DEPARTMENT OF DEFENSE; AND ROBERT B. MINOGUE, DIRECTOR, OFFICE OF NUCLEAR REGULATORY RESEARCH, U.S. NUCLEAR REGULATORY COMMISSION

Dr. BRANDT. Yes, sir, I do, Mr. Chairman.

Mr. Chairman, thank you very much for this opportunity to testify on S. 2284. I will deliver a prepared statement addressing the bill generally.

I am accompanied by representatives of the Department of Energy, the Department of Defense, and the Environmental Protection Agency.

We are all available to answer questions relating to our particular agencies' concerns.

This bill would establish by statute a council, with working groups, to coordinate Federal radiation protection activities and would also establish a Conference on Research Into the Biological Effects of Radiation, with both coordination and research review functions.

We agree fully that coordination of radiation protection activities is of the utmost importance. The nature of the health problems posed by radiation exposure is such that an effective approach to them requires the cooperation of many agencies of the Federal Government.

Our goals are the same as the goals of this bill, but we differ about the mechanisms for reaching those goals. Our difference is largely with process. We believe that the necessary cooperation and coordination is best done without the legislative establishment of administrative structures and, therefore, we would not support the bill. It is our view that there is sufficient authority now for effective coordination and management of radiation protection activities. The Office of Science and Technology Policy, the Office of Management and Budget and the Federal agencies with radiation-related responsibilities are now working hand in hand to assure an effectively coordinated effort across the executive branch for the development of policies, the setting of priorities and the guidance of implementation. We already have structures within the executive branch to do many of the things that this bill would require and, in my view, a statutory requirement of the type represented by this bill would impair the flexibility we now have and, in fact, might make it more difficult to achieve the needed coordination. Let me tell you about some of the activities that are planned or that are now taking place.

The Office of Science and Technology Policy has overall responsibility for science policy coordination in the executive branch. The President's Science Adviser, Dr. George Keyworth, has directed that the Federal Coordinating Council for Science, Engineering, and Technology [FCCSET], will serve as the specific focus in the Executive Office of the President for dealing with radiation protection policies and their coordination. A charter is being developed for this purpose and will provide for a working group of representatives from the concerned agencies of the executive branch that will report directly to the Council.

I am confident that shortly this effort will result in an efficient coordination of these matters at the highest policy level. An initial policy level meeting was held on April 21 regarding radiation policy coordination. The consensus of those present was that FCCSET would be an effective and appropriate mechanism for this purpose.

As you know, there is already a well-developed and highly satisfactory process for coordination of radiation research. The Interagency Radiation Research Committee [IRRC] was created by

the Secretary of HEW pursuant to a Presidential directive in 1980. It is responsible for coordinating the planning, implementation and evaluation of a radiation research program on the biological effect of ionizing radiation and for insuring that this program is carried out efficiently, objectively, openly and in accord with the highest scientific standards. It is chaired by the Director of the National Institutes of Health, but I have been serving until the appointment of a permanent Director of the NIH.

Fourteen agencies are represented on the IRRC, and it has research committees dealing with agency management of radiation research and radiation research strategy. The IRRC receives reports on major radiation research activities of agencies represented on it and is a forum for exchange of information, with one of the major aims of this exchange the avoidance of duplication.

This committee has been an active and valuable force in addressing the scientific issues involved in radiation protection. It has reviewed research proposals of special significance. It reviewed and evaluated the recommendations in the "Report of the Panel of Experts on the Archives of PHS Documents Relating to Effects of Nuclear Weapons Testing on Health." It developed a Federal Radiation Research Strategy based on a variety of fact-finding activities, including a 2-day public meeting in March of 1980. The final document, entitled, "Federal Strategy Research Into the Biological Effects of Ionizing Radiation," was sent to the Congress by Secretary Schweiker on June 30, 1981.

In addition to these formal mechanisms, it is important to recognize the large volume of routine coordination that goes on between agencies on a 1-to-1 basis and through committees on technical issues.

This is an important element of the radiation protection scene. For example, the Department of HHS in concert with the Environmental Protection Agency, developed and presented to the President a series of recommendations aimed at reducing exposure from diagnostic X-rays. This guidance was issued by President Carter in February 1978, and is mandatory for Federal medical care facilities.

In the area of nuclear radiation emergency planning and response, the Federal Emergency Management Agency coordinates respective agency roles and responsibilities in the event of a peace time radiological incident. Several agencies are presently sponsoring a conference of radiation control program directors which serves as a forum for joint Federal-State action on various radiation problems.

This alliance has resulted in the development of "Suggested Regulations for the Control of Radiation," a model authoritative guide for regulatory codes covering all sources of ionizing radiation that are presently used by more than 40 State agencies.

It is intended that policy oversight with respect to these ongoing, cross-departmental radiation protection activities will be provided by the radiation protection policy focus that will be established through the Federal Coordinating Council for Science, Engineering and Technology in the Office of Science and Technology Policy [OSTP].

We believe the present and planned cordinative mechanisms will assure that this subject will receive the necessary attention. A legislative imposition of new structures would drain energy and funds from

the valuable work already taking place, would offer but minimal benefits and would limit flexibility for ongoing management adjustments in this very complex and changing area.

We fully agree with the concerns addressed by this bill. The serious problem of protecting the public from harmful health effects of radiation needs comprehensive, coordinated efforts on a governmentwide basis. By the nature of the problem, many agencies must address it. But I think that this task can best be carried out with the OSTP and the Interagency Radiation Research Committee under existing authorities.

This completes my prepared statement, Mr. Chairman. I and my colleagues from other departments will be happy to answer questions with respect to this bill.

Senator GLENN. Thank you, Doctor.

Mr. Minogue, do you have a prepared statement?

Mr. MINOGUE. Yes, I do, Mr. Chairman.

With your permission, I would like to briefly summarize the highlights of that statement.

My name is Robert Minogue. I am the Director of the NRC's Research Office.

The functions of this office include the responsibility for developing radiation protection standards consistent with Federal guidance for the activities which are regulated by the NRC.

Our standards deal with both occupational exposure and exposure of the general public. Also, we sponsor a limited research program related to improving protection and determining the health effects of ionizing radiation in areas which are specific to activities which we regulate. The Commission will be directly affected by enactment of S. 2284 and we appreciate this opportunity to present the views of our agency on this bill.

Our major comment continues to be the one given in May 1979 when I testified before you on S. 1938, the Federal Radiation Protection Management Act of 1979. That comment is that there is a clear need for a Federal mechanism or organization to insure improved coordination of Federal policy on radiation protection.

The proposed Council on Radiation Protection contained in S. 2284 is one organizational way to meet this need. Other ways can also be effective.

The Office of Science and Technology Policy is examining the need for such coordination and it could be identified as the appropriate organization to be charged with this responsibility. Regardless of its location within the executive branch or under what authority it is established, the mission of the needed organization is to serve as the primary Federal forum to consider and solve issues in radiation protection that reflect agency and public concerns and that have government-wide implications.

This forum must have continuity and exercise flexibility in order to deal effectively with both broad and specific issues and the issues must be dealt with in a coherent and timely manner, including consideration of inputs from all affected interests. Particularly important is the need to insure input from State governments.

In addition to dealing with policy questions, an interagency body can provide for improved coordination of acquisition, analysis and dissemination of data on radiation doses, environmental radioactivity levels, the potential health consequences of low-level radiation exposure, and a more centralized focus for information exchange with national and international scientific organizations. I would hope also that such an organization would lead to accelerated development of Federal radiation guidelines, and an earlier witness gave a number of examples, increased public confidence in Federal radiation protection activities, more efficient and more effective use of agency resources, and a more uniform and comprehensive protection of public health and the environment from the hazards of radiation.

Coordination of Federal research programs addressing the biological effect of ionizing radiation is also needed but this need appears to be being satisfactorily met by the present Interagency Radiation Research Committee chaired by the Department of Health and Human Services, Assistant Secretary for Health.

The most important pertinent areas which the NRC regulates are nuclear powerplants and the associated nuclear fuel cycle and the use of byproduct material in nuclear medicine. In my detailed testimony, I provided a number of specific comments on the bill from that perspective.

Our role, however, in another sense is narrow. We are only part of a very wide ranging area of Federal involvement in radiation issues and recognizing that wide range, that wide extent of Government involvement, I would like to close by emphasizing that we see a clear need for some better mechanism to provide leadership and governmentwide coordination of both policy issues and research programs to insure coherency of policy, effective and prompt resolution of issues and efficient use of national resources.

There are a number of options to meet this function among which are those laid out in S. 2284. Whatever is done, its success will depend on a full-scale commitment by all the participating agencies which is supportive of its function and willing to commit resources.

I will say NRC is fully prepared to support such an effort.

Thank you, Mr. Chairman.

Senator GLENN. Thank you very much.

Dr. Brandt, you suggested that the legislation is not needed. I will ask, are you satisfied with the progress that has been made to date with respect to setting of radiation exposure standards?

Dr. BRANDT. I think we are clearly behind in the setting of those standards, but I do believe that the mechanisms that are currently either in place or being developed will lead to an alleviation of that as promptly as possible.

Senator GLENN. Let me say, I have been very critical of the work of the administration and previous administrations. This to me is a nonpolitical matter. I have been equally critical of both because I think the performance of previous administrations was atrocious and I think we have gone from atrocious to absolutely abhorrent in this administration.

I make no bones about it, as you might have gathered from my original statement this morning.

How do you respond to a statement made by Mr. Peach in his testimony, "EPA has only issued one set of radiation standards in 12 years which was on the diagnostic use of X-rays?"

Dr. BRANDT. Let me ask my colleague from EPA to respond to that.

Mr. BURLEY. Mr. Chairman, in terms of the Federal radiation guidance, that statement is correct. We have issued standards for the uranium fuel cycle, 40 CFR 190 and we have proposed several other guides and standards; namely, a guidance for exposure of populations to transuranium elements, and occupational guidance last year. In terms of promulgated Federal guidance statements, you are correct in terms of overall accomplishments.

Senator GLENN. What is holding it up? Why has EPA not yet developed the necessary radiological standards to guide the decontamination and decommissioning of retired nuclear facilities? We have known of this problem for years and years and yet we sit and look, and don't do a thing about it.

Mr. BURLEY. The decommission standards is a specific case where there is a conflict, there is a conflict between what is actually needed in the real world and a decision on whether we have adequate information to go into a standard setting program for generic standards.

Senator GLENN. Who is the conflict between?

Mr. BURLEY. Effectively it is a technical decision on the part of our agency, that we do not have enough information at this point to go into a rulemaking procedure on generic standards.

The way we have handled it——

Senator GLENN. How are we going about getting information to set those standards?

Mr. BURLEY. We have an active program going, contract and in-house program, to develop information on the consequences of certain disposal methods and the costs.

Senator GLENN. Is this a new study? Because as I recall 3 years ago, we sat in this very room and I heard exactly the same testimony when I asked the same question of the last administration. I think at that time they had a study going.

What happened to it?

Mr. BURLEY. I am not aware of the results of any previous studies. What we have done, Mr. Chairman, is work very closely with the Nuclear Regulatory Commission and the Department of Energy on an ad hoc basis with specific sites and determined what the appropriate decontamination criteria are for those specific sites.

We have not at this point given generic guidance.

Senator GLENN. Why does it take EPA 7 years to release proposed occupational exposure standards for public comments, 7 years?

Mr. BURLEY. I was obviously not involved——

Senator GLENN. Didn't happen on your watch?

Mr. BURLEY. It was a lengthy decisionmaking process.

Senator GLENN. That's for sure.

Mr. BURLEY. It involved a lot of interactions with outside groups, with other Federal agencies and internal delays, there is no question about it.

Senator GLENN. From your viewpoint, why has EPA received only limited cooperation from other agencies and jurisdictional challenges

to EPA's authority, which has been part of the problem, as I understand it?

Mr. BURLEY. I do not think I can answer for the motives of other agencies.

Senator GLENN. Doesn't this point up the need for something in law to coordinate this thing better than we are doing now, if EPA is having trouble getting cooperation from other agencies?

Mr. BURLEY. The proposal that Dr. Brandt enunciated; namely, a policy coordination, obviously is sorely needed. We think that the best place for that would be with the Office of Science and Technology Policy—effectively a working coordination basis rather than a formal council basis.

Senator GLENN. Mr. Peach differed rather strikingly with you that that would be the wrong place to put it.

Mr. BURLEY. We believe there is a role for lead agency in standard setting.

Senator GLENN. I don't disagree with that in principle, and I have always seen EPA as being the logical spot until we were apparently being stonewalled on not getting information from EPA. I wrote a letter, we haven't gotten an answer to it.

As far as I know, we have still not received an answer to this letter in November of last year.

Mr. BURLEY. I apologize.

Senator GLENN. We made calls. We tried to make contact. We found out the letter did get delivered. It is like sailing paper airplanes into the Grand Canyon. We might as well communicate with ourselves up here. We are not getting information.

So, we took a different tack. If EPA is going to zero out all its efforts in this area, we might as well get another agency.

Mr. BURLEY. I am not——

Senator GLENN. November 12, 1981, addressed to Ann Gorsuch, Administrator. We changed courses since we did not get a response from EPA; I think with good justification because, according to the figures we have received, EPA is zeroing out virtually all of its research concerning research on exposure of ionizing radiation; is that true?

Mr. BURLEY. EPA itself is not carrying out research on biological effects of radiation.

We do have contract efforts which are directly related to providing data needed for our standard setting activities. We have not zeroed that out at all.

Senator GLENN. Let me comment on this. We have a working paper here—I understand it is a draft working paper within EPA—of things that were to be zeroed out.

One, empirical and theoretical studies of the transport of radionuclides in the atmosphere, and in the terrestrial and aquatic environments.

Two, the assessment of human exposures to radiation from radionuclides in the surrounding environment, including water supplies, building materials, et cetera.

Three, the uptake of radionuclides in the environment by living organisms, and the assessment of passage to human populations through the food chain.

Four, studies to determine specific sources and routes of exposure in occupational settings.

Five, research to elucidate the fate of radionuclides inhaled or ingested by humans, and to assess the radiation doses received by specific organs and tissues.

All this is under the general title of "Research Needs Concerning the Characterization of Sources of Exposure to Ionizing Radiation."

Is that the policy of EPA, that they are zeroing this out?

Mr. BURLEY. Not to my knowledge. I would have to check specifically on those five titles.

Senator GLENN. Then can you tell me how much money is being provided to look into those because our information is they are being zeroed out.

Mr. BURLEY. I will check that.

Senator GLENN. You don't have that figure?

Mr. BURLEY. I do not have it.

Senator GLENN. Can you give us an estimate of it this morning? Can you tell me for sure money is being included for that, any money?

Mr. BURLEY. Two of those—the last one, as far as I know, is definitely being funded, the uptake of radionuclides. The theoretical studies of environmental transport are being funded under several different categories and are being carried forward.

Senator GLENN. Has this draft gone into effect now?

April 1982, is the date of this draft, this month.

Mr. BURLEY. I have not seen this draft, Mr. Chairman.

Senator GLENN. I will have him bring this down and let you look at it and see if you recognize it.

You heard the figures, Dr. Brandt, I gave a while ago on the number of inspections of equipment, and so on, that the GAO study of 1979 cited. It showed that only about 34,000 of the estimated 138,000 medical X-ray machines in use during fiscal 1979 did not even have any kind of inspection and U.S. Bureau of Radiological Health reported 25 percent of the machines that were inspected were found to be not in compliance yet we are holding up on regulations, holding up programs, and changing around the groups that were beginning to look into this.

When are we going to get going on this? We had 10, 11 years. I have been around here, going into my eighth year now. I have been interested in this ever since I got here. We cannot seem to get anybody to move off dead center. We were trying to coordinate some of these activities with this bill to get something done. Instead it is proliferated all over the lot. Seventeen groups into monitoring, 16 groups into the research.

Dr. BRANDT. I think, in the first place, Mr. Chairman, the 25-percent figure on machines that are not in compliance, in some instance, involves relatively minor things, such as not having a label on the equipment, or some other similar violation.

At the time that report was filed, the FDA responded by pointing out that much of what were being cited as problems in terms of either under- or over-exposure were related more to operator problems than to hardware problems. In fact, over the past few years, the incidence of hardware defects has been decreasing considerably.

As you know, in the last year, the Consumer Patient Radiation Health and Safety Act of 1981 was passed which did, in fact, assign to the Public Health Service the responsibility for implementing programs related to radiation safety.

Senator GLENN. Let's take the equipment out of it, then. There are only 10 States that even have operator licensing, is that correct?

Dr. BRANDT. I believe it is 12, sir.

Senator GLENN. In 1979, it was only 10, so a couple of States have been added.

Dr. BRANDT. We are, in fact, at the present time, developing a model State law. We have been directed by the Congresss to have this accomplished by August of 1982. We are currently on that timetable. We have completed the following steps: We have contacted all appropriate State agencies and professional boards to seek their input on the current practices related to occupational groups, medical radiological technologists, dental hygienists, radiation therapy technologists, and nuclear medicine technologists.

We established a Federal task force and asked it to help us develop the standards. We communicated with professional associations and have met with numerous professional associations, both those representing the technology groups and those representing the employer groups.

Senator GLENN. Congress passed Public Law 97-35 August of 1981 last year during the Omnibus Budget Reconciliation Act of 1981. It had a subtitle, Senator Randolph introduced it, it was called the Consumer-Patient Radiation Health and Safety Act of 1981.

That subtitle provided that within 12 months after date of enactment, Secretary of HHS in consultation with the Radiation Policy Council, VA, appropriate agencies of the States, and appropriate professional organizations shall promulgate minimum standards for the accreditation of educational programs to train individuals and to perform radiologic proceedings. In another section, it is required the Secretary prepare and transmit to the States a model statute for radiologic procedures safety, what you are talking about. If enacted by the State, it would make it unlawful for individuals to perform radiologic procedures unless those individuals went through an accredited State program of education and were certified to perform radiological procedures.

Finally, the Secretary is supposed to, in conjunction with all these other agencies, promulgate Federal radiation guidelines with respect to radiologic procedures. The question is (a) what is to prevent a State from completely ignoring this subtitle as written into the law, since there are no penalties provided if a State refuses to adopt the statute and (b), how can you consult with the Radiation Policy Council in promulgating those guidelines when the Reagan administration disbanded the Radiation Policy Council?

Dr. BRANDT. Obviously we cannot consult with the Radiation Policy Council. That is why we have, in fact, brought in all the other agencies involved and attempted to deal with the issue that way. We will, under the FCCSET arrangement, take it to them. We will meet that deadline of August, unless something happens to our time table.

We have already involved professional associations, State agencies, and so forth. Clearly there is no way under the law that we can mandate that a State develop a licensure procedure for those persons who administer X-rays.

Senator GLENN. Do you think we should have that in law?

Dr. BRANDT. I happen to think we ought to wait and see if the States will develop licensure procedures on their own with our help.

Senator GLENN. Since 1979, we have added 2 States to the 10.

Dr. BRANDT. We have added two States, that is correct. However, we had not in that period also developed the kind of guidelines and standards and models that are proposed under the Consumer Patient Radiation Health and Safety Act. I think once those get out, then more States will probably develop licensure procedures, particularly since we now have the professional associations involved. We will soon provide the States with standards they can easily adopt into law.

The Federal radiation guideline section of that act which you referred to has been assigned to the Bureau of Radiological Health of the FDA. Work is going forward in all areas of responsibility. For example, in the past few years, they have developed guidance on such topics as Gonad shielding, X-rays during pregnancy, and so forth. They are continuing to develop those positions including criteria, to use in determining the indications for certain kinds of X-rays, quality assurance programs for radiation therapy, quality assurance programs for nuclear medicine, census protocol for survey of X-ray facilities and equipment, and a consumer patient educational campaign on diagnostic X-rays.

The Bureau of Radiological Health is, in fact, continuing a process that is required by the Consumer Patient Radiation Health and Safety Act. Again, we intend to meet the requirements of both sections of that act.

Senator GLENN. Mr. Burley, can you tell us what happened to the research budget for radiation of EPA between 1981 and 1982 and between 1982 and 1983?

Mr. BURLEY. I cannot give you specific numbers. There was a sizable reduction in 1981. I retract that. There was a sizable reduction early in 1982 and the budget has gone from about $6 million to less than $2 million for the Office of Radiation programs.

Senator GLENN. That was 1981 to 1982?

Mr. BURLEY. That is correct.

Senator GLENN. How about the new budget, 1982 to 1983?

Mr. BURLEY. 1983 is somewhat in excess of a million.

Senator GLENN. We have gone from $6 million to $1 million?

Mr. BURLEY. That is correct. A large portion of that was a reduction because of cutbacks in the implementation of the Clean Air Act.

Senator GLENN. What is it in terms of manpower research in EPA at that same time, has it gone down on a 6-to-1 ratio also?

Mr. BURLEY. The research of the Office of Radiation program, which is the only organization I can speak of, is that we are engaged in contract research, rather than research on our own.

We do have two laboratories which carry out monitoring and surveillance activities. The contract research is primarily directed toward direct——

Senator GLENN. Research in this area concerns genetic defects and all sorts of things. The funds for that have gone down 6 to 1 and manpower along with it. I presume manpower may be more than 6 to 1. Because as I understand it, these functions that were supposed to be in EPA have not been transferred along with the money to other departments, they have just been killed; is that correct?

Mr. BURLEY. I do not think I can speak to that.

I don't know.

Senator GLENN. Can anyone else at the table answer that? Isn't that basically correct?

There is a 6-to-1 reduction ratio in funding and commensurate manpower reduction, the research is just flat not being done.

Dr. BRANDT. I cannot answer about the specific projects that were under way, but as the chairman of the Interagency Research Committee, I will be happy to provide you with the information as to whether those projects have been picked up by any other agency.

Senator GLENN. No one can answer the question; is that right?

I think that shows the level of coordination we have in our different programs right here at this table. We cannot even answer what the funding is in radiation research.

Gentlemen, I am sorry, we are going to have to break again. There is another vote on over there.

I am sorry, we are going to have to stand in recess now again for a few minutes.

[Brief recess.]

Mr. WEISS. Senator Glenn has called and asked that I go ahead with a few of the questions that he was going to ask, since he apparently is going to be delayed coming back from the floor.

Dr. Brandt, I would like to ask you a couple of questions about the Interagency Radiation Research Committee which is operating today.

First, can you tell us how often it has met during your tenure as Assistant Secretary of Health?

Dr. BRANDT. During my tenure as Assistant Secretary for Health?

Mr. WEISS. Let's say since the start of the Reagan administration.

Dr. BRANDT. Four times.

It has met three times since I have been chairman.

Mr. WEISS. How would you characterize the membership of this committee in the context of S. 2284? Are major Federal agencies involved in radiation research actively and effectively participating in the committee, in your view?

Dr. BRANDT. Yes, sir; they do indeed actively and vigorously participate.

For example, I think it is important to point out that we formed the strategy document last year, and the Secretary sent it to Congress. I have formed a subcommittee of the IRRC to develop an implementation strategy that is due this summer. However, the subcommittee they have already has laid out—by agency—the radiation research that is going to implement the strategy.

This research is not a complete list of all the radiation research that is going on in the Federal Government. To do that would mean involving 20 agencies and departments within the Federal Government with a total radiation research budget of over $100 million. Our focus is principally on research concerned with biological effects of ionizing radiation.

The Interagency Radiation Research Committee now includes: the Department of Health and Human Services, of course; the Department of Energy; Consumer Product Safety Commission; Department of Agriculture; Department of Commerce; Department of Defense;

Department of Energy; and within HHS, the National Institute for Occupational Safety and Health; Food and Drug Administration, and the National Institute of Health.

The IRRC also involves the Department of Labor, Department of Transportation, EPA, FEMA, NASA, National Science Foundation, Nuclear Regulatory Commission, and the Veterans' Administration. So it is a wide-ranging committee.

All of the meetings are well attended. We have approximately five people serving as staff to that committee, not all full time, clearly, but in varying capacities.

I think the committee is working well.

Mr. WEISS. You mentioned your implementation strategy. Let me ask you whether in formulating this strategy, whether the question of insuring that there will be an adequate supply of scientific and technical manpower with appropriate skills to study the effect of ionizing radiation will be part of the implementation strategy.

Dr. BRANDT. I think it is going to be more indirect than direct. It is certainly something I think we could address, although it will be there mainly by implication.

Mr. WEISS. Let me say that in the FREIR Committee report they mentioned specifically that the Nation may not have the necessary expertise to respond to the inevitable crisis and require continuing studies because the large number of people who started in the research business in this area under the AEC are now retiring from research.

The National Academy of Sciences, through the committee, recommended a joint program be established to insure the adequacy of the manpower pool in this field including if necessary the provision of training support.

Senator Glenn has a bill, S. 2421, the National Engineering and Scientific Manpower and Education Act, which is going to address some of these issues. I am sure he would be pleased to hear that your implementation strategy would deal with that issue if, in fact, it is going to do so.

Dr. BRANDT. At the present time it is not intended to deal with it directly. I think my colleague from the NRC may have something to say.

Mr. MINOGUE. Thank you.

I would like to make one observation on an earlier point. One of the considerations in the establishment of that radiation research group, as the Interagency Task Force on Health Effects of Ionizing Radiation deliberated it, was to provide a better forum for the regulatory agencies, which themselves have only very limited research programs and rely instead on research done by the other agencies, an effective mechanism for them to participate in the formulation and identification of research needs and development of research strategies. We feel this process is extremely important and we plan to be very heavy participants in these activities, recognizing that most of the research information we need to make regulatory decisions comes out of programs done in these other agencies.

Dr. BRANDT. Also, I was just advised we will, by September 30, transmit to the Congress a report on manpower in the radiation research area, its needs, and so forth. At that time, we may have some recommendation.

Mr. WEISS. Let me raise one issue concerning research on biological effects. Almost all your information and judgments about the effect of radiation on health stems from studies of the Hiroshima and Nagasaki survivors and are based on dose estimates at Hiroshima and Nagasaki which have been in use since 1955.

Those estimates are based upon certain assumptions concerning the amount of X-rays gamma rays, and neutron radiation absorbed by the survivors after the blast.

Last year, some scientists at the Lawrence Livermore Laboratory challenged the accuracy of the existing radiation data on the grounds that neutron radiation had little measurable effect on people in Hiroshima and Nagasaki and that accordingly it might be necessary to double the risk estimates for developing fatal cancer from exposure to levels of gamma radiation that were present in those explosions.

Presumably nonfatal cancer would also be increased. Such a result could mean that the risks of human cancer induction by gamma and X-ray sources other than atomic weapons, say from medical procedures, would be greater than heretofore acknowledged. I wonder if you could comment on this and tell us what the present state of knowledge is concerning this issue?

Dr. BRANDT. Concerning the issue of the most likely form of radiation influencing——

Mr. WEISS. The issue of the possibility of the effect of gamma radiation being considered more serious than before because the dose estimates from neutron radiation in the Hiroshima and Nagasaki blasts apparently were not correct, at least not according to the people who did this latest study at Livermore.

Dr. BRANDT. The Department of Energy has a study under way to look at the very issue that you have raised. I am out of my area of scientific competency, but I think that the question of the dosage from Hiroshima and Nagasaki as well as the major one of the other influences is not clearly known at the present time, or at least is under some question as you point out. The Department of Energy is, in fact, studying that issue at the moment.

Mr. WEISS. The results of the FREIR Committee report obviously depend very much upon what these dose estimates are. In fact, the whole issue, the biological effect of low-level ionizing radiation extends from extrapolation of that data so it is quite important to get this resolved.

Dr. BRANDT. Yes, sir.

Mr. BURLEY. The National Academy of Sciences, by the way, has a committee established at the moment, which is looking at that particular problem. It will probably take 2 years to reach their estimates and the chief of our Biological Effects Branch in the Office of Radiation programs is heading that study.

Senator GLENN. Mr. Minogue, in data compiled by NRC, it appears although the total number of operating nuclear powerplants in 1980 rose by only one new plant, total worker radiation exposure for all operating nuclear plants increased by about 35 percent. Apparently nuclear plant per worker radiation doses have been rising steeply for the last 3 years. Can you tell us what the reason for this rise is and whether you expect it to continue and is this common in other coun-

tries or is it something peculiar to our operating procedures in this country?

Mr. MINOGUE. Yes, Mr. Chairman, I can respond to that. This trend became evident more than 3 years ago. I would take it back some 5 or 6 years. It largely arises because of many of the operating difficulties and material difficulties we had with these plants which have required more than anticipated in the way of in-service inspection, repair, removal of steam generators, plugging of tubes of the steam generators, etc. That is one major source.

A second major source is that many of the plant modifications that have been required because of the lessons learned from Three Mile Island and from other operating experiences have required workers to go into radiation fields to do the required work.

And the last major source is that there is a slow increase in the radioactivity level in the systems. It is a composite of all of these.

We recognized this trend some years ago as did the industry. A number of steps have been taken to deal with these increased exposures, the development of remote inspection techniques and things of that type; but it is a case of so many of these special maintenance and special access operations being required, even working very hard, running like hell to stay even, if I may use that expression, that there is a rise in this sort of exposure that I would really expect to begin to level off as many of these problems get resolved and fixes are found. This is a matter we have regarded as being quite serious.

Senator GLENN. Will it level off or continue to go up because you have increases in radioactivity in all that equipment over a period of time?

Mr. MINOGUE. Mr. Chairman, actually that is one of the easier things to take care of because you can foresee it and predict it and you know the distribution of radioactivity. It is relatively easier to find solutions to that than find the solution of somebody being required to go into an area where access had not been anticipated.

I think the buildup of activity is a more manageable component of the problem.

Senator GLENN. Mr. Minogue, I would like to ask you another question that involves Cobalt-60. In 1976, there was a tragedy at the Riverside Hospital in Columbus, in fact, about 2 miles from where I live in Columbus, in which nearly 400 cancer patients had been exposed to up to 40 percent excess radiation because of an error in dose calculations for a Cobalt-60 therapy unit. There are more than 100 lawsuits already on file and I predict more to come as a result of that operation of that one machine. What are we going to do to prevent something like that from happening again?

Are there other cases like that around the country just undiscovered?

Mr. MINOGUE. Mr. Chairman, our regulations now include a requirement that teletherapy machines be periodically recalibrated. That requirement was intended to deal with this specific problem.

Senator GLENN. Is that a Federal regulation now on all Cobalt-60 machines?

Mr. MINOGUE. Yes, on those which we regulate. I will furnish the detail to the committee on the precise reference.

[The information referred to follows:]

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

May 11, 1982

The Honorable John Glenn
United States Senate
Washington, D. C. 20510

Dear Senator Glenn:

This letter confirms my response to your questions on cobalt-60 teletherapy calibration raised during my testimony before the Subcommittee on Energy, Nuclear Proliferation and Government Processes on April 29, 1982. The Nuclear Regulatory Commission published a notice in the Federal Register on January 8, 1979 (44 FR 1722), of an amendment to 10 CFR Part 35, "Human Uses of Byproduct Material," that added new sections 35.21 through 35.25 listed under the heading "Special Requirements for Teletherapy Licensees." A copy of the amendment, which became effective July 9, 1979, is enclosed.

The cobalt-60 teletherapy amendments require that three quality control measurements be performed at three different time intervals to ensure the accuracy of doses from cobalt-60 radiation therapy machines:

(1) At two year intervals (and after servicing) licensees are required to calibrate the dosimetry systems used for full calibration of teletherapy units. These dosimeters must be calibrated by the National Bureau of Standards or a Regional Calibration Center.
(2) At one year intervals (and after servicing and when a spot check measurement varies more than 5% from the last full calibration) licensees are required to perform a full calibration on all teletherapy units.
(3) At one month intervals licensees are required to perform a spot-check measurement on all teletherapy units.

In that same part of my testimony, my focus on the distinction between X-ray and Cobalt-60 teletherapy resulted in a less than complete description of the regulation of Cobalt-60 units. In 24 of the 50 states, NRC regulates these units directly; in the remaining 26 states, the so-called "Agreement States," the units are regulated by the State governments all of which require calibration comparable to that required by NRC.

The regulation of teletherapy units is an on-going process. In addition to the regulations mentioned above, the NRC has recently published a proposed rule, presently out for comment, that is intended to provide greater assurance that teletherapy unit malfunctions do not occur and that they will be detected before serious injury can occur to patients or operating personnel. The proposed rule for monitoring and inspecting Cobalt-60 teletherapy units is contained in the enclosed Federal Register notice (47 FR 18131) published on April 28, 1982.

Sincerely,

Robert B Minogue

Robert B. Minogue, Director
Office of Nuclear Regulatory Research

Enclosures: (2)
(1) § 35.21
(2) Proposed Rule 10 CFR Part 35

ENCLOSURE

PART 35 • HUMAN USES OF BYPRODUCT MATERIAL

(i) Whenever spot-check measurements indicate that the output value differs by more than 5 percent from the value obtained at the last full calibration corrected mathematically for physical decay;

(ii) Following replacement of the radiation source or following reinstallation of the teletherapy unit in a new location;

(iii) Following any repair of the teletherapy unit that includes removal of the source or major repair of the components associated with the source exposure assembly; and

(3) At intervals not exceeding one year.

(b) Full calibration measurements required by paragraph (a) of this section shall include determination of:

(1) The exposure rate or dose rate to an accuracy within ±3 percent for the range of field sizes and for the range of distances (or for the axis distance) used in radiation therapy;

(2) The congruence between the radiation field and the field indicated by the light beam localizing device;

(3) The uniformity of the radiation field and its dependence upon the orientation of the useful beam;

(4) Timer accuracy; and

(5) The accuracy of all distance measuring devices used for treating humans.

(c) Full calibration [illegible] shall be made in accordance [illegible] the procedures recommended by the Scientific Committee on Radiation Dosimetry of the American Association of Physicists in Medicine (*Physics in Medicine and Biology*, Vol. 16, No. 3, 1971, pp. 379-396).[1]

44 FR 1722

(d) The exposure rate or dose rate values determined in paragraph (b)(1) of this section shall be corrected mathematically for physical decay for intervals not exceeding one month.

(e) Full calibration measurements required by paragraph (a) of this section and physical decay corrections required by paragraph (d) of this section shall be performed by an expert qualified by training and experience in accordance with § 35.24.

§ 35.22 Requirement to perform periodic spot-check measurements of teletherapy units.

(a) Any licensee authorized under § 35.13 to use teletherapy units for treating humans shall cause spot-check measurements to be performed on each teletherapy unit at intervals not exceeding one month.

(b) Spot-check measurements required by paragraph (a) of this section shall include determination of:

(1) Timer accuracy;

(2) The congruence between the radiation field and the field indicated by

[1] This incorporation by reference provision was approved by the Acting Director of the Federal Register on August 6, 1976. Copies are available for inspection or may be obtained from U.S. Nuclear Regulatory Commission, Public Document Room, 1717 H Street, NW., Washington, D.C. 20555.

Special Requirements for Teletherapy Licensees

§ 35.21 Requirement to perform full calibration measurements of teletherapy units.

44 FR 1722

(a) Any licensee authorized under § 35.13 to use teletherapy units for treating humans shall cause full calibration measurements to be performed on each teletherapy unit:

(1) Prior to the first use of the unit for treating humans;

(2) Prior to treating humans:

[†] Amended 41 FR 16445.

the light beam localizing device;

(3) The accuracy of all distance measuring devices used for treating humans;

(4) The exposure rate, dose rate, or a quantity related in a known manner to these rates for one typical set of operating conditions; and

(5) The difference between the measurement made in paragraph (b)(4) of this section and the anticipated output, expressed as a percentage of the anticipated output (i.e., the value obtained at last full calibration corrected mathematically for physical decay).

(c) Spot-check measurements required by paragraph (a) of this section shall be performed in accordance with procedures established by an expert qualified by training and experience in accordance with § 35.24. (A qualified expert need not actually perform the spot-check measurements.) If a qualified expert does not perform the spot-check measurements, the results of the spot-check measurements shall be reviewed by a qualified expert within 15 days.

44 FR 1722

§ 35.23 Requirement to calibrate instruments used for full calibration and spot-check measurements.

(a) Full calibration measurements required by § 35.21 shall be performed using a dosimetry system that has been calibrated by the National Bureau of Standards or by a Regional Calibration Laboratory accredited by the American Association of Physicists in Medicine. The dosimetry system shall have been calibrated within the previous two years and after any servicing that may have affected system calibration.

(b) Spot-check measurements required by § 35.22 shall be performed using a dosimetry system that has been calibrated in accordance with paragraph (a) of this section. Alternatively, a dosimetry system used solely for spot-check measurements may be calibrated by direct intercomparison with a system that has been calibrated in accordance with paragraph (a) of this section. This alternative calibration method shall have been performed within the previous one year and after each servicing that may have affected system calibration. Dosimetry systems calibrated by this alternative method shall not be used for full calibration measurements.

§ 35.24 Qualified expert.

The licensee shall determine if a person is an expert qualified by training and experience to calibrate a teletherapy unit and establish procedures for (and review the results of) spot-check measurements. The licensee shall determine that the qualified expert:

(a) Is certified by the American Board of Radiology in Therapeutic Radiological Physics, Radiological Physics, Roentgen-Ray and Gamma-Ray Physics, or X-ray and Radium Physics; or

(b) Has the following[2] minimum training and experience:

(1) A Master's or Doctor's degree in physics, biophysics, radiological physics or health physics;

(2) One year of full-time training in therapeutic radiological physics; and

(3) One year of full-time experience in a radiotherapy facility including personal calibration and spot check of at least one teletherapy unit.

44 FR 1722

§ 35.25 Records.

The licensee shall maintain, for inspection by the Commission, records of the measurements, tests, corrective actions, and instrument calibrations made under §§ 35.21-35.23 and records of the licensee's evaluation of the qualified expert's training and experience made under § 35.24.

(a) Records of (1) full calibration measurements under § 35.21 and (2) calibration of the instruments used to make these measurements under § 35.23, shall be preserved for five years after completion of the full calibration.

(b) Records of (1) spot-check measurements and corrective actions under § 35.22 and (2) calibration of instruments used to make spot-check measurements under § 35.23, shall be preserved for two years after completion of the spot-check measurements and corrective actions.

(c) Records of the licensee's evaluation of the qualified expert's training and experience under § 35.24 shall be preserved for five years after the qualified expert's last performance of a full calibration on the licensee's teletherapy unit.

94-649 O - 82 - 3

Proposed Rules

Federal Register
Vol. 47, No. 82
Wednesday, April 28, 1982

This section of the FEDERAL REGISTER contains notices to the public of the proposed issuance of rules and regulations. The purpose of these notices is to give interested persons an opportunity to participate in the rule making prior to the adoption of the final rules.

NUCLEAR REGULATORY COMMISSION

10 CFR Part 35

Teletherapy Room Radiation Monitors and Inspection and Servicing of Teletherapy Machines

AGENCY: Nuclear Regulatory Commission.

ACTION: Proposed rule.

SUMMARY: The Nuclear Regulatory Commission (NRC) is proposing amendments to its regulations applicable to NRC teletherapy licensees that are intended to ensure prior warning to the operator in the event of a malfunction of a teletherapy source exposure mechanism and to ensure adequate inspection and servicing of the teletherapy machine. The amendments under consideration would require:

1. The installation of radiation monitors in teletherapy rooms;
2. The use of portable survey instruments whenever the permanent radiation monitors are inoperable; and
3. The inspection and servicing of all teletherapy machines to assure proper functioning of the source exposure mechanism, during source replacement or at intervals not to exceed five years, whichever comes first.

DATE: Comment period expires June 28, 1982. Comments received after this date will be considered if it is practical to do so, but assurance of consideration cannot be given except as to comments received on or before this date.

ADDRESSES: Written comments should be submitted to the Secretary of the Commission, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, Attention: Docketing and Service Branch. Copies of the comments on the proposed amendments may be examined at the Commission's Public Document Room at 1717 H Street NW., Washington, D.C.

FOR FURTHER INFORMATION CONTACT: Mr. Alan K. Roecklein, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555 (phone 301-443-5970).

SUPPLEMENTARY INFORMATION: In May 1980, the Office of Nuclear Material Safety and Safeguards issued orders to all NRC teletherapy licensees requiring the installation of teletherapy room radiation monitors and the use of portable radiation survey meters when the installed monitors are inoperable. In 1972 the NRC established a standard teletherapy license condition requiring inspection and servicing of all teletherapy machines to assure proper functioning of the source exposure mechanisms at time of source replacement or every five years, whichever comes first, and requiring that a record of the inspection and servicing be kept on file for review by the Commission's Office of Inspection and Enforcement. These actions were intended to provide early warning of, and to help prevent, potentially serious over-exposures of teletherapy operators and patients in the event that the source exposure mechanism failed.

The radioactive sources contained in teletherapy units produce radiation fields on the order of hundreds of rads per minute in areas accessible to patients or operators. An undetected exposed source could result in overexposures of patients or operating personnel in a short period of time. Teletherapy units are designed with reliable source handling components. In spite of careful design the NRC is aware of a number of teletherapy equipment malfunctions that had the potential for causing serious overexposures. the proposed rule changes described in the summary are intended to provide greater assurance that teletherapy equipment malfunctions do not occur and that they will be detected before serious injury can occur.

It is the Commission's intent to codify the previously described orders and license condition so that they are uniformly applicable to existing licensees and new applicants.

Paperwork Reduction Act Statement

This proposed rule is being submitted to the Office of Management and Budget for review under the Paperwork Reduction Act of 1980 (Pub. L. 96-511) since it codifies a recordkeeping requirement.

Regulatory Flexibility Statement

The Regulatory Flexibility Act of 1980, 5 U.S.C. 605(b), became effective January 1, 1981. The Act establishes as a goal that agencies try, consistent with the objectives of rules and applicable statutes, to fit regulatory and informational requirements to the size of businesses being regulated. To assure that this is done, an agency proposing a rule is required to (a) prepare an initial regulatory flexibility analysis of the proposed rule if the rule will have a "significant economic impact on a substantial number of small entities," or (b) certify that the rule will not have such an impact.

Based on the information available at this time, and in accordance with the Regulatory Flexibility Act, the Commission hereby certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. About 440 teletherapy licensees are regulated by the NRC. Fewer than 1% of these can qualify as small entities for the purposes of the Regulatory Flexibility Act applying the standards contained in 13 CFR Part 121, Small Business Size Standards. All but a few of the teletherapy licensees are hospitals and the Small Business Administration defines small hospitals as having fewer than 150 beds. A check on 104 of NRC teletherapy licensees showed that all of them had more than 150 beds.

The NRC believes that all teletherapy licensees have already installed monitoring equipment and have portable survey instruments available in compliance with the 1980 orders. The cost of an installed monitor and survey instrument is approximately one thousand to fifteen hundred dollars. The approximate cost of a teletherapy unit exceeds one hundred thousand dollars. Annual revenue generated by a teletherapy unit is on the order of 200,000 dollars. Costs for the inspection, servicing, and recordkeeping requirements will be proportional to the number of units owned by the licensee. An estimate of cost is less than 500 dollars per year per teletherapy unit. Thus the Commission believes that the proposed rule will not have a significant economic impact on a substantial number of small entities.

The gains in patient and operator protection will significantly outweigh the economic impact on licensees. Accordingly, as provided by the Regulatory Flexibility Act of 1980, 5 U.S.C. 605(b), the Commission hereby certifies that this proposed rule will not have a significant economic impact on a substantial number of small entities.

Any small business entity subject to this regulation which determines that because of its size, it is likely to bear disproportionate adverse economic impact, should inform the Commission of this in a comment that provides the following information:

(a) The licensee's size in terms of annual receipts, number of employees, number of patient beds and annual number of teletherapy procedures;

(b) How the proposed regulations would result in a significant economic burden upon the licensee as compared to larger licensees;

(c) How the proposed regulations could be modified to take into account the differing needs of capabilities of the commenter;

(d) The benefits that would accrue, or the detriments that would be avoided, if the proposed regulation were modified as suggested by the commenter; and

(e) How the regulation, modified as suggested in (c) above would still adequately protect the public health and safety.

List of Subjects in 10 CFR Part 35

Byproduct material, Drugs, Health facilities, Health professions, Medical devices, Nuclear materials, Occupational safety and health, Penalties, Radiation protection, Reporting requirements.

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974, as amended, and section 553 of title 5 of the United States Code, notice is hereby given that adoption of the following amendments to 10 CFR Part 35 is contemplated.

PART 35—HUMAN USES OF BYPRODUCT MATERIAL

1. The authority citation for Part 35 continues to read as follows:

Authority: Secs. 81, 161, 182, 183, 68 Stat. 935, 948, 953, 954, as amended; (42 U.S.C. 2111, 2201, 2232, 2233); sec. 201, 88 Stat. 1242, as amended by Pub. L. 94-79, 89 Stat. 413 (42 U.S.C. 5841).

For the purposes of section 223, 68 Stat. 958, as amended (42 U.S.C. 2273); §§ 35.2, 35.14 (b), (c) and (f), 35.21(a), 35.22(a), 35.24, and 35.31 (b) and (c) are issued under sec. 161b, 68 Stat. 948, as amended (42 U.S.C. 2201(b)); and §§ 35.14(b)(5) (ii), (iii) and (v) and (f)(2), 35.25 and 35.31(d) are issued under sec. 161o, 68 Stat. 950, as amended (42 U.S.C. 2201(o)).

§ 35.25 [Redesignated as § 35.27]

2. The present § 35.25 is redesignated § 35.27.

3. A new § 35.25 is added to read as follows:

§ 35.25 Requirements to install a permanent radiation monitor in teletherapy rooms and to use portable survey instruments.

(a) Each licensee authorized under § 35.13 to use teletherapy units for treating humans shall install a permanent radiation monitor in each teletherapy room for continuous monitoring of beam status.

(b) Each radiation monitor must be capable of providing visible notice of a teletherapy malfunction that may result in an exposed or partially exposed source. The visible indicator of high radiation levels must be located so as to be observable by a person entering the room and during operation of the unit.

(c) Each radiation monitor must be equipped with an emergency power supply separate from the power supply to the teletherapy unit. This emergency power supply may be a battery system.

(d) Each radiation monitor must be tested for proper operation each day before the teletherapy unit is used for treatment of patients.

(e) If a radiation monitor is inoperable for any reason, any person entering the teletherapy room shall use a portable survey instrument to monitor for any malfunction of the source exposure mechanism that may have resulted in an exposed or partially exposed source.

4. A new § 35.26 is added to read as follows:

§ 35.26 Inspection and servicing of the source exposure mechanism.

(a) The licensee shall cause each teletherapy machine used to treat humans to be fully inspected and serviced during source replacement or at intervals not to exceed five years, whichever comes first, to assure proper functioning of the source exposure mechanism.

(b) Inspection and servicing of the teletherapy machine shall be performed by persons specifically authorized to do so by the Commission or an Agreement State.

5. In redesignated § 35.27 the introductory text and paragraph (a) are revised to read as follows.

§ 35.27 Records.

The licensee shall maintain, for inspection by the Commission, records of the measurements, tests, corrective actions, inspection and servicing of the teletherapy machine, and instrument calibration made under §§ 35.21 through 35.26 and records of the licensee's evaluation of the qualified expert's training and experience made under § 35.24.

(a) The following records must be preserved for five years after completion of the full calibration or inspection and servicing:

(1) Full calibration measurements reports made under § 35.21.

(2) Records of calibration of the instruments used to make these measurements under § 35.23.

(3) Records of inspection and servicing of the teletherapy machine under § 35.26.

* * * * *

Dated at Washington, D.C., this 22d day of April 1982.

For the Nuclear Regulatory Commission.

Samuel J. Chilk,

Secretary of the Commission.

[FR Doc. 82-11660 Filed 4-27-82; 8:45 am]
BILLING CODE 7590-01-M

Senator GLENN. Are there any Cobalt–60 machines you do not regulate?

Mr. MINOGUE. No, sir, we regulate Cobalt–60 machines.

Senator GLENN. All of them?

Mr. MINOGUE. What I was trying to imply is X-ray machines are not regulated by us, and that Cobalt–60 is.

Senator GLENN. Any Cobalt–60 machine being used in this country will be regulated by NRC?

Mr. MINOGUE. Yes, teletherapy machines.

Senator GLENN. Are these checked or do you just put out guidelines?

Mr. MINOGUE. It is in the regulations. It don't remember the specifics. I think it is a requirement to recalibrate every 2 years, but I will have to furnish the precise wording for the record.

Senator GLENN. We have a letter here sent back to me by you some 3 years ago, Mr. Minogue. It was March 8, 1979, when we were having hearings. We asked for specific information regarding regulatory programs to assure proper calibration of the teletherapy units using the NRC license material, which will be Cobalt–60 and you provided information at that time, which was good, but one of your statements was that:

> In a not unrelated rulemaking procedure NRC proposed all medical licensees, one, keep records of all misadministrations of radioactive material and, two, promptly report potentially dangerous misadministrations to the NRC, the patient's referring physician, or the patient's responsible relative. We received approximately 150 comments, the vast majority opposed to the rulemaking, and are presently analyzing these comments for the Commission as part of the final rulemaking procedure.

Can you tell me what the followup was to that?

Mr. MINOGUE. That regulation was issued, Mr. Chairman. I must say, though, in the implementation of it, it is not clear that it has been fully cost-effective. It has generated a lot of reports that have not really tended to provide new insights into regulatory approaches that could be used to deal with the problem.

It was implemented by the Commission on an interim trial basis and we are now reexamining the effectiveness of it and may modify it to try to achieve the same goal, but with somewhat less regulatory burden.

Senator GLENN. Colonel Stroud, can you bring us up to date as to the latest result of the study of soldiers who participated in the nuclear test, the so-called "Smoky" test, and do you have an updated figure of exposure levels for participants in that exercise?

Colonel STROUD. Mr. Chairman, an agency of Dr. Brandt's, has been working with this problem. I believe he has more up-to-date information.

Dr. BRANDT. The Centers for Disease Control has been following the 3,217 military participants. We have been able to track down 94 percent of them. The most recent data that has been verified was published in October of 1980 and demonstrated an increased incidence of leukemia in these participants. As a matter of fact, nine cases of documented leukemia were identified as compared to three and a half that would have been anticipated from ordinary everyday exposure.

The interesting thing, however, about that is that the mortality in this group of 3,217 people is well below the anticipated mortality that

we would expect from persons not so exposed. This is an interesting observation that most people do not understand, but we feel likely represents an expected well-worker effect.

I should say there are certain other malignancies that show up at slightly higher rates, including malignant melanoma and certain eye cancers and brain tumors. It may turn out that over continued follow-up that these others will increase, but that is pure speculation.

Senator GLENN. Is there adequate funding to continue the studies?

Dr. BRANDT. There is funding to continue the studies, yes.

Senator GLENN. Is it adequate?

Mr. BRANDT. In our opinion it is adequate, yes. We will know better as the study progresses.

Senator GLENN. Has that funding also been cut back?

Dr. BRANDT. The funding for this project, to my knowledge, has not been cut back. I can get the exact figures.

[The information referred to follows:]

Funding for this project is provided out of the CDC appropriation for ongoing program operations and has remained basically stable.

Estimated costs:

Fiscal year:	
1979	$40,100
1980	37,300
1981	41,000
1982	45,000

Senator GLENN. Gentlemen, I appreciate your testimony. We could go on hour after hour here. We are going to have to move on to the next panel.

I would appreciate your responding, if you would, please, to any questions or additional things we might wish to submit to you for inclusion in the record here, either from other members or the committee staff.

I appreciate your being here this morning.

Thank you very much.

[Mr. Minogue's prepared statement follows:]

TESTIMONY OF ROBERT B. MINOGUE

TO THE

SUBCOMMITTEE ON ENERGY, NUCLEAR PROLIFERATION

AND GOVERNMENT PROCESSES

OF THE

SENATE COMMITTEE ON GOVERNMENTAL AFFAIRS

APRIL 29, 1982

My name is Robert Minogue. I am the Director of the Nuclear Regulatory Commission's Office of Nuclear Regulatory Research. Among the functions of this office are the responsibility for developing radiation protection standards for the activities regulated by the NRC. Also, we sponsor a limited research program related to improving protection and determining the health effects of ionizing radiation in areas specific to activities which NRC regulates.

These functions and the primary mission of the Commission to protect public health and safety will be directly affected by enactment of S.2284 - the Federal Radiation Protection Management Act of 1982. Therefore I am pleased to have this opportunity to present the views of our agency on S.2284.

Our major comment is the one given in May, 1979 when I testified before this Subcommittee's predecessor on S.1938 - the Federal Radiation Protection Management Act of 1979; that is, the need for a Federal mechanism to insure coordination of Federal policy on radiation protection. The proposed Federal Council on Radiation Protection contained in Title I of S.2284 is one organizational way to meet this need. Other ways can also be effective. The Office of Science and Technology Policy is examining the need for such coordination and it could be identified as the appropriate organization to be charged with this responsibility. Regardless of its location within the Executive Branch or under what authority it is established, the mission

of the organization is to serve as the primary Federal forum to consider and resolve pervasive issues in radiation protection that reflect agency and public concerns and that have government-wide implications. This forum must have continuity and exercise flexibility in order to deal effectively with both broad and specific issues, and the issues must be dealt with in a coherent and timely manner with efficient use of technical and administrative resources.

Agencies must have confidence in the structure and procedures established for the interagency coordinating body that these criteria will be met and that inputs from all affected interests in our society, particularly those from State governments, will be considered in any resolution reached. Operating in such a way, the organization can be effective in enhancing public understanding of ionizing radiation and perhaps increase public acceptance of decisions that must be made in radiation protection.

In addition to dealing with policy questions, an interagency body can provide for improved coordination of the acquisition, analysis, and dissemination of data on radiation doses, environmental radioactivity levels, the potential health consequences of low-level radiation exposure, and a more centralized focus for information exchange with national and international scientific organizations. I would hope also that such an organization would lead to accelerated development of Federal radiation guidelines, increased public confidence in Federal radiation protection activities, more efficient and more effective use of agency resources, and more uniform and more comprehensive protection of public health and the environment from the hazards of radiation.

Coordination of Federal research programs addressing the biological effects of ionizing radiation is also needed, but this need appears to be satisfactorily

met by the present Interagency Radiation Research Committee, chaired by the Department of Health and Human Services' Assistant Secretary for Health.

As to the responsibilities of the NRC in radiation protection, the Commission has a legislative mandate to protect public health and safety for activities that involve the production, use, or disposal of source materials,[1] special nuclear materials,[2] or byproduct materials.[3] In general, the NRC exercises this mandate by licensing the use of these radioactive materials. This includes the licensing of nuclear power plants, waste disposal facilities, hospitals, manufacturers and distributors of consumer products, and other sources using or producing radiation and radioactive materials covered by the Atomic Energy Act.

The radiation standards established by the NRC control both occupational radiation exposure and exposure of members of the public from licensed operations. These standards follow the Federal radiation guidance prepared by the former Federal Radiation Council.

In the area of biological effects of radiation, NRC sponsors limited research to develop information on exposures and consequent health risks specific to our regulatory needs. However, we rely primarily on information on biological effects from programs supported by other agencies and from work in other countries.

[1] Source materials are natural uranium and thorium ores and their concentrates.
[2] Special nuclear materials include uranium enriched in uranium-235, uranium-233, and plutonium.
[3] Byproduct materials include radioactive materials which are produced in conjuction with the use of special nuclear materials or which result from the production of source materials and include uranium mill tailings.

I have the following specific comments on S.2284 to offer for your consideration:

(1) In Sec. 101(a)(2) and Sec. 201(a)(3) include the Presidents of the National Academy of Sciences and the National Council on Radiation Protection and Measurements, or their designees. This would authorize attendance of representatives of these two expert scientific bodies at meetings of the Federal Council on Radiation Protection and the Federal Conference on Research into the Biological Effects of Radiation and their opportunity to formally provide advice. Both organizations have played important roles in radiation protection for many years and continue to serve as vital resources for technical expertise and judgements on basic tenets accepted in radiation protection.

(2) The scope of radiation sources to be addressed by the Council and Conference should be clearly delineated in Sec. 102(a)(1) and Sec. 202(a)(1) by providing a definition for "radiation." The present wording could include any form of radiation, for example microwaves and if the Committee wishes to limit the scope to ionizing radiation the legislation ought to so state. Also, in Sec. 102(a)(1) the Council should be authorized to respond to requests from State governments for guidance when no Federal agency has clear regulatory responsibilities.

(3) The listing of a review of nuclear power plant regulation in Sec. 102(a)(2)(D) should be extended to include all facilities in the nuclear fuel cycles.

(4) The Working Group on Protection from Exposures to Medical Radiation should be renamed to explicitly limit its scope to medical x-rays. This change would be in concert with the tasks it is to undertake.

(5) A provision should be included in the Act that would allow the Council to establish other Working Groups it deems necessary, without the need for specific legislative authority.

(6) In Sec. 203(a)(2) the scope of this opportunity for a Federal agency to

have the conference "review any proposal for studies on the human health effects of radiation" should be extended to allowing such requests for any radiation related studies that are designed to provide information of human health effects. Many long-term studies that involve large animal colonies could benefit from such review by the Conference. The review would of course remain optional with the Federal agency sponsoring the study.

In connection with the reviews conducted by the Conference, we applaud the emphasis in S.2284 on reviews making determination of "sufficient scientific merit" of proposed studies.

In summary, because of the wide extent of the regulatory and other government activities that involve radiation exposures and issues, we see a need for mechanisms to provide leadership and government-wide coordination of both radiation policy issues and research programs to assure coherency of policy, effective and prompt resolution of issues, and efficient use of national resources. A number of options exist as to organizational approaches which can effectively meet these objectives, among which are those laid out in S.2284.

The success of whatever organizational structure is established will require that the member agencies be supportive of the functions and willing to commit their resources. NRC will fully support such efforts.

Senator GLENN. The next panel this morning is Dr. Warren K. Sinclair, president of the National Council on Radiation Protection and Measurement; Mr. Heyward Shealy, chief, Bureau of Radiological Health, South Carolina Department of Health and Environmental Control; Mr. Robert Alvarez, Environmental Policy Center; Mr. Lionel Lewis, Duke Power Co., Atomic Industrial Forum.

We appreciate your being here this morning.

Dr. Sinclair, since your name was first on the list, why don't you lead off?

TESTIMONY OF WARREN K. SINCLAIR, PRESIDENT, NATIONAL COUNCIL ON RADIATION PROTECTION AND MEASUREMENTS; HEYWARD SHEALY, CHIEF, BUREAU OF RADIOLOGICAL HEALTH, SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL; LIONEL LEWIS, DUKE POWER CO., ATOMIC INDUSTRIAL FORUM; AND ROBERT ALVAREZ, ENVIRONMENTAL POLICY CENTER

Mr. SINCLAIR. Thank you, Senator Glenn.

My name is Warren Sinclair. I have a Ph. D. in physics and a background in biophysics and radiology.

I am presently president of the National Council on Radiation Protection and Measurements.

I am on leave from my position at Argonne National Laboratory in Chicago. The NCRP is a not-for-profit corporation, charted by the Congress, which publishes reports on all aspects of radiation protection. I have a couple of these reports in my hand. They happen to be reports that have been produced recently and at the end of each published report are details about the 75-person Council membership, collaborating organizations, committee structure, publications, the financial support and the actual congressional charter.

Senator GLENN. Does the committee have copies of those publications?

Mr. SINCLAIR. They certainly may have.

Senator GLENN. I would appreciate it if we could have copies for our record.

[The Subcommittee on Energy, Nuclear Proliferation, and Government Processes has the following publications from the National Council on Radiation Protection and Measurements in the subcommittee files:]

Annual Report, 1981.

Basic Radiation Protection Criteria, Report No. 39.

Krypton-85 in the Atmosphere—Accumulation, Biological Significance, and Control Technology, Report No. 44.

Natural Background Radiation in the United States, Report No. 45.

Influence of dose and its Distribution in Time on Dose-Response Relationships for Low-Let Radiations, Report No. 64.

Radiofrequency Electromagnetic Fields—Properties, Quantities and Units, Biophysical Interaction, and Measurements—Report No. 67.

Radiation Protection in Pediatric Radiology—Report No. 68.

"How Well Can We Assess Genetic Risk? Not Very" by James F. Crow—Lecture No. 5.

Critical Issues in Setting Radiation Dose Limits: Proceedings of the Seven-

teenth Annual Meeting of the National Council on Radiation Protection and Measurements, April 8–9, 1981—Proceedings No. 3.

The National Council on Radiation Protection and Measurements.

Krypton—85 in the Atmosphere—with Specific Reference to the Public Health Significance of the Proposed Controlled Release at Three Mile Island: May 16, 1980.

Preliminary Evaluation of Criteria for the Disposal of Transuranic Contaminated Waste: February 5, 1982.

Mr. SINCLAIR. I might say, Senator, since I last appeared before you, the NRCP has produced something like a dozen of these reports on different radiation protection subjects.

The NCRP has consistently supported efforts to improve coordination of Federal programs related to radiation protection and research on the effects of both ionizing and nonionizing radiation. The NCRP has also consistently supported the concept of a high level body to effect the needed coordination.

Consequently, we are strongly in support of the spirit of this bill which we perceive as an effort to coordinate and manage the Federal effort better in the important fields of protection from ionizing and nonionizing radiation. We do, however, have some questions and reservations on this bill, some of which are discussed below.

One general reservation is that this bill appears to view the problem as one of solving temporary difficulties of a jurisdictional nature between the different Federal agencies. We view this as only part of the problem and not the major part. We believe that a council and conference are needed on a continuing basis to coordinate the comprehensive aspects of radiation protection and to maintain responsibility for and authority over such general matters as standards of safety for workers and the general public.

Concerning title I, the Federal Council on Radiation Protection, our first question is whether or not the scope of this Council is intended to be limited to ionizing radiation. Because while ionizing radiation may currently be perceived to be our greatest problem, nonionizing radiation also affects people in not well-understood ways.

Senator GLENN. Maybe we could answer that right now. That is not just ionizing radiation, that is all radiation that may prove to be a problem.

Mr. SINCLAIR. Thank you.

The second concerns the chairmanship of the Council. In the bill it is to be assumed by the Secretary of Health and Human Services.

In our view, it is questionable whether the chairmanship should be occupied by any of the agencies involved in the Council, however dedicated their attitudes, since each, unavoidably, has a specialized interest. Alternative, more neutral arrangements for the chairmanship, such as the Director of the Office of Science and Technology Policy, should be considered. At least the staff arrangements should clearly be distinct from those of the staff of the Secretary of Health and Human Services.

Third, this bill appears to concentrate excessively on jurisdictional issues, as indicated above. While we support the notion that the FCRP should review the authority of the agencies to regulate in matters relevant to radiation protection, we believe that congressional designation of agency responsibilities should be clear and the authority of the

Council should also be clear, and that unnecessary time should not be wasted on jurisdictional matters. We also note that there may be special problems in national security in relation to the development and testing of nuclear weapons in view of the membership of the Council.

The fourth comment concerns the requirement that the Council develop and recommend programs to educate the public. This is a new and important responsibility which should be accepted by the Council. This should be either an important operating initiative for the Council itself or for one or more of the agencies the Council designates to be responsible.

Five, the specification of the working groups to be established goes into great detail and leaves little room for judgment on the part of the Council. Would it not be preferable to specify that the working group mechanism is to be used to deal with certain representative problems and give the Council the authority and responsibility to set up what it perceives is needed?

Furthermore, the specification of the tasks of the working group on occupational exposure, for example, shows an unwarrantable bias in the direction of reduction when what is needed is an objective evaluation.

Again, the list of the tasks of the working group on medical exposure specifies such details that unjustified intrusion into the practice of medicine may be the only result rather than objective evaluation.

It must be possible to insure that objective evaluations are achievable without constraining the flexibility and initiatives of the Council unnecessarily.

The sixth item, the termination requirement indicates that the provisions of the bill are aimed at correcting what seems to be a temporary situation. The NCRP believes that a consistent Federal effort at coordination will be necessary indefinitely in this field of protection from radiations.

Concerning the Conference on Research Into the Biological Effect of Radiation, first, again, the scope of the Council came into question, but I understand if the Council is to embrace ionizing and nonionizing radiation, I assume the Conference does also.

I think it ought to be clarified.

Again, the chairmanship of the Conference is to be assumed by the Director of the National Institutes of Health. This is probably to be preferred among the agency choices available, but consideration should again be given to extra-agency chairmanship.

As indicated for the Council, staff arrangements should be clearly distinct from those of the normal staff of the National Institutes of Health so that the Conference role is clear and distinct.

It is not clear to us why the public members of the Conference are not to be compensated while those of the Council are. It would seem that both should be treated alike.

Fourth, the limitation of the Conference's responsibilities to biological effects seems too narrow. We suggest including a more general term in section 202, perhaps as follows:

"The Conference shall—

"(1) advise the President with respect to research activities concerned with the biological effects of radiations and other related

studies." This would insure that related matters such as measurements and the assessment of levels important to the study of biological effects would not be excluded.

Five, we support the notion that the FCRBER review studies which the agencies propose to support. It should be clarified, however, whether the Conference is to review all studies in the subject area; that is, including those not proposed for support as well as those proposed for support.

While it is not desirable for the Conference to trespass on mission related responsibilities in the agencies, the review function should insure that a balanced research program is developed as a composite of all agencies. Additional support available to the Conference itself may even be necessary to insure that balance.

Sixth, the termination requirement again suggests a temporary fix to a perceived temporary situation. In our view, if a successful working plan can be developed by this mode, it should be continued.

Finally, the relationship of the Conference to the Council is most important. We wonder whether a single member representing the Conference on the Council and vice versa, is adequate to insure this.

In that connection, it should be noted that the Council has a responsibility to identify the research needed by the Federal agencies in order to effectively meet their regulatory responsibilities, and this would seem to imply some possibility of confusion between the research roles of the two bodies.

In summary, the NCRP strongly supports the bill in principle, criticizes some of its provisions, believes less detailed instructions to the Council and Conference would be appropriate and is of the opinion that these bodies should not terminate, but continue their functions indefinitely.

Senator GLENN. That is good constructive criticism. We will look into those.

Mr. Shealy, would you care to make any comments?

Mr. SHEALY. Mr. Chairman, members of the subcommittee, ladies and gentlemen, my name is Heyward Shealy, representing the Conference of Radiation Control Directors as its chairman-elect.

I am pleased to be able to present the views of the conference on S. 2284. The conference is an organization whose membership is comprised of all directors of radiation control organizations of 50 States and several cities and territories.

Senator GLENN. Could I stop you right there?

How many States actually have programs right now? We were talking about only 10 States had active programs a while ago and two added to it. How many States have actual overall programs?

Mr. SHEALY. Fifty States are represented in the Conference of Radiation Control Program Directors as having a program.

Senator GLENN. They are members of the group.

That doesn't mean their State actually has laws in effect on radiation standards.

Mr. SHEALY. Most States do have some type of law. Some are more comprehensive than others, Senator. It would depend whether a State is an agreement State or nonagreement State.

Based on specific legislation that particular State would have, would more or less dictate what type program that particular State would have.

Senator GLENN. If you were here a while ago, when we were talking, about 10 States have standards of inspection and standards that are required on a regular basis for inspectors coming around and then there was testimony that two States have been added to that since 1979, were those figures in error?

Mr. SHEALY. No, sir, I think what we are talking about here, Senator, is, we have 10 or 12 States that regulate one aspect of radiation control. That is persons who operate X-ray producing equipment.

Senator GLENN. That would be a valid figure, then?

Mr. SHEALY. Yes, sir.

Senator GLENN. Twelve States have that?

Mr. SHEALY. All of the programs represented have experienced similar difficulties in dealing with Federal agencies regarding control of radioactive materials and radiation exposure.

We would like to see one body to which we could look for communication, information, and action.

I could cite numerous examples of the problems we have encountered, but three will serve to illustrate the point.

One, States in which nuclear plants are located must have an emergency response plan and demonstrate the ability to implement the plan. The Federal Emergency Management Agency is the lead agency for reviewing and evaluating the plan. One of the requirements set forth in NUREG–0654, the emergency planning "bible," is that States be able to recommend that the public evacuate, take shelter, or refrain from eating possibly contaminated foods on the basis of protective action guides to be issued by EPA. Some of the required guides were issued in draft form in 1975. Although plans must be approved in order for a nuclear plant to receive an operating license for full-power operation, the PAG's still have not been issued in final form. The State is therefore caught between two agencies with separate responsibilities and no apparent coordination.

Two, another requirement of NUREG–0654 is that States have plans for issuing radio protective drugs in the event that the release of radioactive iodine is imminent. I am aware of only one company licensed by FDA to manufacture the drug potassium iodide in the proper doses, and the shelf life of its large unsold inventory was due to expire in December 1981. No one wanted to buy an expired drug, the company had not scheduled another production run, and inquiries of FEMA and FDA were fruitless. At the 11th hour, the shelf life of existing stocks has been extended to December 1982; however, we in the States are still faced with basically the same problem.

Three, States concerned about the transportation of radioactive materials have asked for Federal assistance either in inspecting shipments or in taking corrective actions against shippers located in other States or otherwise beyond the regulatory reach of the State. NRC and the Department of Transportation have been slow to decide on a consistent interpretation of their respective regulations and how they interrelated. In our review, the inspection program still has gaps in it.

The conference submitted a resolution to Congress in 1973, addressing these concerns, and our position was reaffirmed in a letter to this committee in 1978. John R. Stanton, who is the current chairman of the conference, testified before this subcommittee in 1979 endorsing the proposed Federal Radiation Protection Management Act of 1979. We likewise endorse the bill under consideration today as it contains many provisions the conference considers important in addressing the concerns expressed in our previous resolutions and testimony.

The conference wants to see a strong centralized group to perform several functions: To insure that all sources of radiation exposure are evaluated; to review regulatory coverage for gaps and omissions; to recommend assignments of responsibility to various agencies; and, to channel research effort leading to development of standards, technical bases, and regulations—both Federal and model State. To further these goals, the conference would like to see State involvement in all phases of the proposed Council. We request that the subcommittee consider involving a State representative on the Working Group on the Reduction and Control of Occupational Exposure.

The States have been involved in radiation control for a number of years, often in areas which have received little Federal attention. Participation in conference activities has convinced me that State staffs contain a number of experienced and willing people; the conference itself is one channel by which their expertise is directed toward matters of common concern. These same concerns are the subject of this bill, and we are anxious to see established a coordinating group such as the one which this bill will create.

Thank you for providing the conference an opportunity to comment on this bill and this completes my formal presentation. I shall be glad to respond as far as I am able to any questions. Furthermore, I shall convey any written questions you may have to the executive board or the conference for reply.

Senator GLENN. Thank you, Mr. Shealy.

Mr. Lewis, do you have a statement?

Mr. LEWIS. Yes, sir, I do.

My name is Lionel Lewis. I am the system health physicist for the Duke Power Co. of Charlotte, N.C. My company and approximately 600 other domestic and foreign organizations are members of the Atomic Industrial Forum which is an international management association involved in the peaceful uses of nuclear technology. The forum's program activities are conducted through the active participation and assistance of committees and study groups. AIF provides a forum for its member groups to arrive at a consensus on policy and technical issues.

I am here today as chairman of the AIF Subcommittee on Occupational Radiation Protection which is one of the operating groups within the Forum's Committee on the Environment. I also am a member of the Steering Group of the AIF Committee on the Environment. However, time has not permitted their review and concurrence with my comments today. We appreciate your invitation to appear before this Senate subcommittee to present our views on S. 2284 which would establish a Federal Council on Radiation Protection and a Federal Conference on Research Into the Biological Effects of Radiation.

Our views on organizational issues concerning Federal radiation health and safety programs were presented earlier to the Senate Committee on Governmental Affairs by letter dated May 17, 1979, and in testimony presented to the Subcommittee on Radiation Protection Research and Regulatory Issues in May 1979. The current bill contains several significant changes to provisions that were in earlier versions.

As indicated to the Senate subcommittee earlier, we believe that the concept such as the one proposed in S. 2284 would provide measurable benefits in coordinating radiation protection activities among the Federal agencies if properly constituted with a designated mission. In this connection, it is also critical that an agenda responsive to national needs and unique to a council concept be developed and rigorously followed.

The present bill proposes a concept of a Federal Council on Radiation Protection with the Secretary of HHS as chairman, which appears to be patterned after the former Federal Radiation Council, which existed from 1959 to 1970. A Council so organized should be able to provide the leadership required to develop uniform national policies for radiation protection of the general public and for individuals working in radiation related activities. However, in order to perform effectively and serve a useful function, the Council requires budgetary support, qualified staff, and the continuing interest of the participating agencies.

In our judgment, the recent Radiation Policy Council, in existence from 1979 to 1981, did not receive adequate support to accomplish its designated mission nor was it apparent that all agency members of the Council had sufficient commitment to its activities to insure maximum effectivenesss.

There are several especially important coordinating functions which a group such as a council could perform that cannot be adequately handled by one agency under the present system of fragmented responsibility. The AIF testified before the Radiation Policy Council on several of these issues and copies of these statements are attached to my testimony for the record.

One example of these coordinating functions that is of utmost importance to us is the area of public radiation information and education. The state of the public's understanding of the effects of radiation is distressingly low with misinformation often given extraordinary prominence. The need for programs to inform the public was emphasized in the Kemeny Commission report following the accident at Three Mile Island and by the Interagency Task Force on the Health Effects of Ionizing Radiation.

There is a real need for the Federal Government to assure that agencies publicly disseminate scientifically accurate information based on the recommendations of our prestigious national scientific bodies such as the National Council on Radiation Protection and Measurements and the National Academy of Sciences, as well as similar international groups. As discussed in our statement before the Radiation Policy Council the coordination of such programs was to be an important function of the Council, but the RPC was unable to fulfill this role. It is significant that the present bill acknowledges the importance of this particular problem.

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Another important coordinating role, that could be extremely useful, is in the area of standards where several agencies have designated responsibilities. Additionally, examining the possible consolidation of some of the radiation responsibilities now scattered through a number of agencies could be a beneficial role for this Council.

The proposed Council appears to be structured in a manner similar to the former Federal Radiation Council with the additional feature of including one representative from the Conference of Radiation Control Program Directors and two public members. These additions properly acknowledge the importance of the State's role in controlling radiation as well as the needed outside expertise that can be provided by knowledgeable public participation.

In this connection, we would urge that at least one of the public members be designated as a member representing NCRP. This would provide the Council with necessary scientific expertise from the principal nationally recognized authority on the health effects of radiation.

S. 2284 also requires the Council to establish a working group on the reduction and control of occupational exposure to radiation. This appears to be one of several interagency working groups which the Council would need in order to study the various priority areas where efforts should be focused.

While it is useful to review all aspects of occupational exposure to radiation, several of the proposed specific working group responsibilities listed in the bill appear to be similar to the existing delegated responsibilities of individual agencies. The proper study and control of occupational exposure reduction would also require technical input from those whose job it is to design for and implement regulatory requirements. For example, various segments of the nuclear power industry have conducted extensive programs to reduce occupational exposure, including AIF, the Electric Power Research Institute, nuclear utilities, the Institute of Nuclear Power Operations [INPO], manufacturers of nuclear steam supply systems, architect-engineers, consultants, universities and others. Utilities also conduct effective dose reduction [ALARA] programs at their nuclear powerplants. This vast body of information would have to be digested by the working group and factored into its deliberations.

All information developed by AIF, for example, could be made available to such an effort but also is routinely provided to the Nuclear Regulatory Commission and to the Environmental Protection Agency, who have designated responsibilities in this area.

A Conference on Research into the Biological Effects of Radiation would be established by S. 2284 to coordinate Federal research programs. An executive order established an Interagency Radiation Research Committee in February, 1980 with functions similar to those being proposed for the conference. The Interagency Committee is still intact and from all reports has been quite effective in reviewing and assuring the usefulness of major research efforts.

Although we have no particular view on the mechanism for achieving adequate coordination to utilize funds in the most effective day, we do believe that interagency coordination of radiation research, including establishing criteria for peer review of research projects, is an essential function.

In this connection, we would like to state that radiation probably is the most thoroughly understood environmental hazard and certainly the most regulated. Therefore, thorough scientific review of all research, both before initiation of projects and following their completion, is essential if funds are to be spent effectively and if controversies involving research on the health effects of low-level radiation are to be avoided.

Finally, the bill appears to contain a "sunset" provision for the Council. We would urge careful consideration of this aspect of the proposed legislation. The FRC was established in 1959 and terminated in 1970 with its responsibilities transferred to EPA, a Radiation Policy Council with different type responsibilities was established in 1979 and then terminated in 1981, and now a Council is proposed, again with possible abandonment in several years.

The periodic starting up and termination of this funtcion in our opinion has been somewhat disruptive to the Nation's radiation protection policy although occupational radiation protection programs have continued to be successfully implemented.

This concludes my formal presentation. Again, thank you for your invitation to present our views on this important subject.

I will be pleased to attempt to answer questions, if you wish.

Senator GLENN. Thank you very much, Mr. Lewis.

Mr. Alvarez, do you have a statement?

Mr. ALVAREZ. I am Robert Alvarez, Washington representative for the Environmental Policy Center, a private nonprofit lobbying organization.

Mr. Chairman, EPC is grateful for this opportunity to present out views on S. 2284. With your permission, I would like to summarize some of my testimony insofar as some of it has been covered previously by the speakers.

Senator GLENN. Your entire statement will be included in the record.

Mr. ALVAREZ. Thank you.

We can expect the already inadequate radiation protection activities of the Federal Government to deteriorate further without a clear statutory mandate from Congress to rectify the problem. In this context the EPC commends Senator Glenn for his concern in this area and offers support for S. 2284.

I would like to make the following comments on specific parts of the bill:

Title I, establishing a Federal Council on Radiation Protection is essential to any effort to set and enforce radiation exposure standards. I think we are all in agreement with that, mainly because of the scattered nature of Federal responsibility in this area.

We also support the Department of HHS being in the lead position as opposed to EPA, for reasons covered earlier in this hearing, mainly because politization of the EPA has rendered it ineffective.

We do not support the current administration's approach in placing this responsibility in the Office of Science and Technology Policy.

Radiation protection is not a primary problem of science and technology policy, it is a public health problem and by bringing it in-house to a White House advisory panel, you are removing this responsibility further from public review and accountability.

We think the Department of HHS is a much more appropriate chair and coordinating body for any Federal radiation policy council.

We believe that your bill correctly targets two key areas for immediate corrective action, occupational exposure standards and reduction of needless medical X-rays. Again, the whole problem of fragmented and scattered jurisdictions is placing an inordinate burden of excessive exposure on workers.

Two specific things we would like to recommend in the context of occupational exposure is, one, that the Government should set a limit on the level of collective exposures accrued at any given nuclear powerplant or nuclear facility. This is a specific problem which is now facing our reactor industry. Sweden and Ontario Hydro Canada is in the process of implementing this concept. In other words, setting a limit on the total number of workers that would be exposed in a nuclear powerplant. Otherwise, you can increase the number of temporary workers dramatically and, thus, raise the health mortality risk of that particular group.

Another area of concern to us is that we believe there should be a better regulatory regime over occupational exposure of DOE plants and State agreement programs regulated by the NRC. We propose that the Occupational Safety and Health Administration be given authority to regulate the DOE facilities and that the NRC establish minimum Federal standards for worker exposures in State agreement programs. These standards would set forth criteria for penalties for violation and revocation of license which simply do not exist today.

Our third area of concern is recommendation of the International Commission on Radiation Protection contained in their publication No. 26. Current efforts to revise occupational exposure standards are going on in partial context to these recommendations.

We believe if the Government were to adopt ICRP 26 in its total form, it could lead to a dramatic relaxation of exposure standards. For example, ICRP recommends a 50-rem annual limit for single organ doses. This is where radiation is deposited in one organ alone.

A 50-rem dose extended over a 30-year period means accumulative dose to workers of 1,500 rems.

If the Nuclear Regulatory Commission were to accept this limit, 23 out of 49 of their maximum permissible concentrations would be raised, some as much as 10 times.

With your permission, I would like to put two attachments in the record, one concerning acceptable exposure of commercial nuclear powerplants and comment on ICRP 26.

Senator GLENN. They will be included in the record following your prepared statement.

Mr. ALVAREZ. Medical radiation, of course, is the largest source of human external radiation exposure to the public. In 1979, the American population received over 270 million individual X-rays.

In 1980, some $6.7 million was spent on radiology equipment and insurance of personnel. Less than one-half of the 300,000 people currently employed operating medical and dental X-ray equipment have received formal training.

Senator GLENN. Why don't you stop and read that paragraph again so everybody listens to it.

Mr. ALVAREZ. Medical radiation is the largest source of human made external radiation exposure to the public. In 1979, the American population received over 270 million individual X-rays. In 1980, some $6.7 million was spent on radiology equipment, insurance, and personnel.

Less than one-half of the 300,000 people currently employed operating medical and dental equipment have received formal training.

Senator GLENN. Think about that the next time you go to your dentist.

Mr. ALVAREZ. One of the principal causes of needless exposure to patients is that untrained personnel usually have to perform retakes or the machines are not calibrated properly. Many programs exist in the States which have been covered in these hearings.

In August of 1981, the Consumer Patients Radiation Safety Act was passed and calls on Department of HHS to establish Federal minimum standards for accreditation of educational programs to train individuals to perform radiologic procedures and certification of persons who administer radiologic procedures.

Once this model law is available, the States have 3 years to comply with it. In early 1982, HHS officials met with allied health profession and consumer health representatives to express the Department's intention of devising the standards and model law. Whether the States will adopt the Federal guidelines is unclear. There are no provisions of the act to compel States to comply.

We think that the Federal Council on Radiation Protection, would insure some form of compliance because right now the law that was passed last year does not have the force to carry this model law out in the States.

We do agree with the concept in title II of a Federal radiation research policy council or a conference on federal radiation research. However, as long as the nuclear weapons industry has a monopoly over Federal funds in this area of research, a Federal conference will in essence be ineffective to deal with conflict affecting both nuclear technologies and public health protection.

We propose an amendment added which reads:

There is to be transferred to the Department of Health and Human Services all functions of the Departments of Energy and Defense to research regarding the health effects of radiation on human beings, including those functions described in sections 31 through 33 of the Atomic Energy Act of 1954 and sections 103 and 107 of the Energy Reorganization Act of 1974, which relate to research regarding the health effects of radiation on human beings.

In 1979, the President's Interagency Task Force of Ionization Radiation determined that DOE controls 60 percent of all Federal funding on the health effects of ionizing radiation. The DOE is in the business of making nuclear weapons and promoting nuclear power first and foremost.

One merely has to read the Atomic Energy Acts of 1946 and 1954 to ascertain these two functions constitute the principal statutory mandates of that agency. Research that may adversely affect DOE's nuclear weapons and power promotion mandate has been subject to a well-defined pattern of suppression, harassment, and intimidation of scientists who are at odds with official radiation risk estimates. To date,

the DOE is potentially liable for $2 billion in radiation damage claims filed against them just by residents who have had to live near the Nevada test sites. That is about two-fifths of the authorized budget for the DOE's nuclear weapons program in 1983. This conflict is a serious one in terms of DOE controlling research that will in essence determine the degree of their liability. This conflict continues today and is reflected in the deficiencies in the management of radiation epidemiology by the Department and the inability or unwillingness of the Federal Radiation Research Committee to deal with these problems.

Unlike the National Institutes of Health, the DOE does not follow standard contract procedures of competitive bidding, peer review and protocol in the awarding of research contracts involving the health effects of DOE-contract workers on citizens living near DOE facilities. I thoroughly agree with a previous statement made by the gentleman from AIF. There needs to be a thorough and standard criteria for review of research prior to letting of contracts. Instead, at the Department of Energy research contracts are given on the basis of personal contacts and the ability, we believe, of DOE to ultimately control the research findings.

In 1974, DOE decided to terminate a research contract held by Dr. Thomas Mancuso at the University of Pittsburgh. Mancuso refused to publicly attack positive findings of excess cancer observed among Hanford nuclear workers in Washington State. He later published positive finding of his own at which time DOE unilaterally turned Mancuso's contract over to Oak Ridge associate universities, a Government-owned contract operated institution. This contract was let without proper peer review, scientific protocols to an organization which did not have a principal investigator to conduct the study. Later, ORAU was forced to farm out this research to the University of North Carolina after a negative in-house review of OR's handling of this contract.

Again, the contract was unilaterally given to the University of North Carolina which, by the way, has a very respected program in industrial medicine and industrial epidemiology. However, the contract was not given to that particular department. It was given to researchers who never did this kind of research before. Later, part of the other contract, concerning the Hanford workers which Dr. Mancuso held, was given to Battelle-Northwest under the direction of Sidney Marks, Mancuso's former DOE contract officer, who orchestrated Mancuso's termination. The Battelle contract also was let without proper procedures.

Battelle-Northwest had not done radiologic epidemiology work before. The past research of Oak Ridge Associated Universities and Dr. Marks is now subject to litigation involving malpractice in the case of ORAU and defrauding the court in the case of Dr. Marks. ORAU is being sued for malpractice on the basis of radiation experiments involving cancer patients who are part of a research program for NASA to determine the radiobiological effect of manned space flight. In 1975, this research project was stopped after a peer review found little or no therapeutic benefit to the patients and that the desire of the researchers to conduct interspecies comparison between mice and people was life-threatening to patients with compromised immune systems.

Dr. C. C. Lusbaugh who was given control over the Oak Ridge part of the Mancuso study stated in the final contract report on this human study program for NASA, "these unbiased data were sorely needed to defend existing environmental and occupational well-meaning but impractical theorists." In terms of Dr. Mark's research, a House Subcommittee on Oversight Investigations showed that research coauthored by Dr. Marks was manipulated to convince a 1956 Federal court that fallout from a 1953 nuclear weapons test did not result in the deaths of thousands of sheep grazing on nearby ranges. This suit has been reopened by sheepmen involved in the 1956 case and is moving forward in Federal district court in Salt Lake City.

The credibility of the Department of Energy in the area of health effects research can never recover from disclosures of conflicting interests.

We urge this agency be removed from the health effect research business altogether.

This concludes my testimony, Mr. Chairman.

Senator GLENN. Thank you very much, all of you.

Dr. Sinclair, in the NRC worker registration registry, how do you rate that? Is it good, how does it compare with the Canadian system, are you familiar with that?

Mr. SINCLAIR. You asked me if the NRC Registry is good?

Senator GLENN. Does it work, is it good, how does it compare with other nations, particularly the Canadian system?

Mr. SINCLAIR. I think the NRC system is fairly good. It is my understanding that the Canadian system is excellent.

Senator GLENN. Are you familiar enough with it that you could tell us whether there is a need to further consolidate and improve the management of this worker registration registry?

Mr. SINCLAIR. I think it is clear that the NRC responsibility does not include all radiation workers, and therefore, their registry does not include all radiation workers.

Presumably a council, once formed, would be able to encompass all radiation workers.

Senator GLENN. How does the Canadian system differ from ours mainly, do you know?

It has been held up as better or more effective than ours. I don't have all the details on exactly how they do their program.

Mr. SINCLAIR. I am sorry, I cannot comment on that in detail.

Senator GLENN. Anybody else have any comment on that, familiar with it?

Mr. ALVAREZ. I do know the Canadians, at least in terms of trying to control collective exposures, are taking very progressive steps which is to limit the total person rem exposure at each plant which is something this country should consider.

Just a little brief comment about the NRC and the worker registry, the NRC is in the process of revising the 10 CFR part 20 which are standards which apply to radiation workers under NRC licenses. These draft revisions we have seen could raise some serious problems to the establishment of a worker registry because they will eliminate the need to maintain cumulative exposure records for workers in exchange for

eliminating another loophole that exists right now that allows workers to receive more than their quarterly limits.

[Subsequent to the hearing the following letter was received:]

ENVIRONMENTAL POLICY CENTER,
Washington, D.C., May 21, 1982.

Hon. JOHN GLENN,
U.S. Senate,
Washington, D.C.

DEAR SENATOR: I am writing to correct a statement I made before your hearings on the Radiation Protection Management Act of 1982 (S. 2284) on April 29, 1982. On page 97 of the hearing transcript I state that NRC draft revisions of 10 CFR Part 20 will eliminate the need to maintain cumulative exposure records in exchange for eliminating another loophole which exists right now that allows workers to receive more than their quarterly limits."

After the hearings Dr. William Mills of the NRC was kind enough to point out the error of my statement. I was referring to proposed Environmental Protection Agency guidance for Occupational exposure of January 23, 1981 which implied the absence of a complete cumulative record keeping system. The NRC position on this matter, according to documentation provided to me by Dr. Mills shows that the NRC indeed wishes to strengthen its cumulative record keeping system for occupational exposures.

I did not mean to infer that the NRC is not being irresponsible. Despite differences we have with the NRC on worker exposure standards, we have found the NRC, in comparison with the Energy and Defense Departments and the EPA, to be the most responsible of the federal radiation protection regimes.

Sincerely,

ROBERT ALVAREZ,
Washington Representative.

Senator GLENN. One of the problems of the Consumer Patient Radiation Health and Safety Act of 1981 as enacted is that the penalties just are not there. Do you think that act can be effective if you do not have some sort of penalties imposed for failure to comply with the act?

Mr. ALVAREZ. I believe that without some clear set of penalties or some clear deadline that has to be enforced, you will see a spotty adoption of this program that will be based on abilities of States to come up with the money, when there may be other higher priorities, or let's say, political or economic considerations.

There are situations in many States right now where a doctor can grab someone off the street, put him in front of an X-ray machine and have him irradiate patients. I don't believe without some clear Federal mandate that is specified through certification that this kind of practice will cease.

Senator GLENN. Mr. Shealy, or anyone else, do you want to reply to this? We talked a little bit about a number of States who have regulation on this, as well as two other things, not only training people, as you mentioned, Mr. Alvarez, and the type of operations we have, or lack of training, but also the equipment itself, inspections, whether the settings were correct, whether overdoses are possible. Even underdoses can be a problem if you do not get the proper information from the X-ray, since then you re-X-ray and go through that do a duplicative procedure which once again results in additional exposure so it is dangerous in either direction.

What can any of you tell the committee about whether this is improving; are more States taking up standards and putting teeth into their laws, making inspections, training people or is this something that is not going to occur outside of some sort of Federal mandate?

Mr. SHEALY. Senator, if I may, I think the situation in the various States is improving as far as legislation being passed, regulations being adopted to enforce standards for equipment and facilities the equipment is utilized in. I think this is improving. I feel the 1981 act that you just referred to has gotten the attention of State decisionmakers.

Senator GLENN. In 1979, when we had that report from GAO, of course, there were only 10 States. Now in 1982 we have moved up to 12 States. At that current rate, that gives us 38 to go at 2 per year, that is 19 years before we even have States in compliance, I guess, if we continue at that same rate. People don't seem to be very excited about this. We had some articles published back home in Ohio that I referred to earlier in the paper in the State Capital, the Columbus Dispatch. I cited some of those figures earlier, and that caused a flurry of interest at that time. Is that what we need or do we need Federal regulation? What do we need? The genetic effects, the possibility of cancer being caused instead of cured, all the different problems that we all are familiar with in this, it is tragic to see this go on and on and yet we hate to jump in once again at this time of defederalism and refederalize programs like this. Is that the only answer?

Mr. SHEALY. Senator, I can only answer for my State. This act has gotten the attention of Iowa decisionmakers in the State that I regulate the radiation control program in. We are studying, we have technical advisory groups that are looking at the situation that involve the medical-dental communities and I feel in our State some action will come out of this.

And I feel good about it.

Of course, as I said again, I cannot speak for all States, but I believe this has gotten the attention of States. We are working now with the Bureau of Radiological Health in FDA and developing model guidelines for States to adopt, model legislation.

I feel very good about it at this time.

Senator GLENN. Does anybody else wish to comment?

Mr. SINCLAIR. I think this bill will certainly help. We must draw attention to radiation protection matters in the States. I know in many of them the climate is moving in this direction.

Senator GLENN. Anyone else?

Mr. LEWIS. I might say, Senator, having worked with the general public for a long time in regard to nuclear radiation, they have been programed through various means—media, whatever—to think of hazards of radiation as coming from nuclear powerplants and medical X-rays as being innocuous, not equating the two. So this is an area where certainly regulatory agencies could exert some public information and training.

Senator GLENN. We are short on time and I will close with some comments here and these are coming off the top of my head because I didn't bring the actual figures with me.

Out of Three Mile Island, that everyone was so concerned about and justifiably so, a near disaster, of all the radiation released out of Three Mile Island, in the worst area of escaping radiation, 5 miles downwind, the average radiation received by anyone from Three Mile Island was 1.7 millirems. Five rems or 5,000 millirems is what we consider as being a dangerous level per year in this country.

The average person in the country receives about 100 millirems per year just from natural causes. A dental X-ray is 17, as I recall, 17 millirems average on a properly adjusted machine, and a chest X-ray is about 75. Those are figures I just seem to recall. I think that gives the order of magnitude anyway, that a dental X-ray gives you about 10 times the radiation that anyone received downwind of Three Mile Island, just to put the whole thing in proper perspective. I am not trying to excuse the mistakes that were made at Three Mile Island that led up to that, but I am trying to put in perspective that the average person in this country receives far greater danger from medical procedures and their diagnostic procedures than they are probably ever going to get from any other source, and receive about 100 millirems per year on the average. It runs up to 160 to 175 in high altitude areas like Denver, I believe. It is somewhere around 60 to 75 near sea level. The average for the country is around 100 millirems per year, just from natural background radiation.

Gentlemen, we appreciate your patience with us this morning. It is almost 12:15 here. We appreciate your remaining this long.

Thank you very much.

We will accept the statements of Thomas W. Philbin and Lauriston S. Taylor for the record.[1]

[The prepared statement of Mr. Alvarez (with attachments) and an addendum to the testimony of Mr. Sinclair follows:]

[1] See pp. 111 and 120.

Statement of
Robert Alvarez
before the
Subcommittee on Energy, Nuclear Proliferation, and Federal Services
U.S. Senate Committee on Governmental Affairs
April 29, 1982

I am Robert Alvarez, Washington Representative for the Environmental Policy Center, a private non-profit environmental lobbying organization. Mr. Chairman, the Environmental Policy Center is pleased and grateful for this opportunity to present our views on S.2284, "The Federal Radiation Protection Management Act of 1982". For the past seven years, EPC has worked actively to reform federal radiation protection and research programs to reflect greater concern for human health and environmental protection. Despite the initiatives of the Carter Administration, which reviewed federal radiation protection and research programs and attempted to establish order to the chaotic standard-setting process and shift research coordination to public health agencies, the basic problems which threaten the health and safety of workers and the public remain.

We can expect the already inadequate radiation protection activities to deteriorate further without a clear statutory mandate from Congress to rectify the problem. In this context, the Environmental Policy Center commends Senator Glenn for his consistent concern in this area and offers its support for S.2284.

EPC would like to make the following comments on specific parts of the bill:

Title I, establishing a Federal Council on Radiation Protection (FCRP) is essential to any effort to set and enforce radiation exposure standards. The Reagan Administration zero-budgeted the Federal Radiation Policy Council established under President Carter by Executive Order. This action leaves federal radiation protection programs in a state best described as scattered and fragmented. At least eleven federal departments, two independent commissions, three advisory panels and fifty states have some authority to set or enforce standards for ionizing radiation.

EPC also supports the transfer of the Environmental Protection Agency's (EPA) guidance function under the Executive Reorganization Act of 1970, to the FCRP.

The EPA record in radiation protection has been fraught with interagency and Congressional conflicts, thus strangling any consistent and meaningful efforts by the agency to fulfill its responsibilities. We believe that the Department of Human and Health Services (HHS), at this time, is a more appropriate chair for the Council because it has a statutory mandate to protect public health and is less likely to undergo the kinds of "politicization" which has rendered the EPA ineffective.

The membership of the FCRP is commendable, particularly with the inclusion of public members. Including the public as actual participants in the decision-making process will greatly enhance the credibility and acceptance of the council by citizens across the country.

S.2284 correctly targets two key areas for immediate corrective action: the revision of occupational exposure standards and reduction of needless medical X-rays. In 1980, the EPA estimated that about 1.5 million Americans are exposed to ionizing radiation in their jobs. A clear and uniform standard-setting or regulatory regime to protect these workers does not exist. As an editorial in the Journal of Health Physics stated in 1980: "Policies vary from location to location. Regulations and regulatory guidance are in such a hopeless muddle that it is impossible to derive consistent practices. Thus many exposures...go unrecorded or unrecognized."

This hopeless muddle has resulted in an increase in worker actions against nuclear industry employers -- a clear sign of the absence of responsible federal radiation protection practices. Lack of proper protection has resulted in increased exposures to workers, particularly at nuclear power plants and isotope by-product facilities subject to state regulation under the Nuclear Regulatory Commission's (NRC) State Agreement Program. For example, between 1979 and 1980 worker exposures at nuclear power plants increased by thirty five percent. This reflects a steady and sharp increase in occupational exposures at nuclear power plants above official predictions. In 1972, the EPA predicted annual exposure levels for reactor workers would not exceed 225 millirem by the year 2000. Within six years, the reported average exposures at atomic reactors more than tripled the EPA prediction. A major problem in the reactor industry is the use of temporary workers or "sponges" to handle the industry's burgeoning maintenance and repair problems. Between 1969 and 1979, the number of U.S.

operating reactors increased 950 percent, from seven to sixty seven reactors. Total doses to workers, however, rose four times as fast, nearly 3,200 percent from 1,247 person-rems in 1969 to 39,759 person-rems in 1979. Total electricity generated during the period did not keep pace with worker exposures, it rose 2,321 percent between the years 1969 and 1979. The total amount of radiation to the total workforce is not regulated by the NRC or any other agency.

Nuclear plants radiation releases to the environment are regulated according to limits set by the EPA. EPC believes that a limit should be placed on the collective doses accumulated by workers at nuclear reactors and other nuclear facilities. Without this limit, the pool of unrecorded exposures to transient nuclear workers will continue to expand dramatically. (See attachment #1).

Another specific area of concern is the need to impose a better regulatory regime over occupation exposures at Department of Energy (DOE) plants and state agreement program facilities. EPC proposes that the Occupational Safety and Health Administration be given authority to regulate DOE facilities and that the NRC establish minimum federal standards for worker exposures in State Agreement programs. These standards should set forth clear criteria for violations, penalties and revocation of licenses.

Their third area of concern is the recommendations of the International Commission of Radiological Protection (ICRP) contained in their publication No. 26. ICRP 26, if adopted by the federal government, would lead to a serious relaxation of exposure standards, specifically in the area of single organ internal exposures. (See attachment #2).

Medical radiation is the largest source of human-made external radiation exposure to the public. In 1979, the American population received over 270 million individual X-rays. In 1980, some $6.7 billion was spent on radiology equipment, insurance, and personnel. Less than one-half of the 300,000 people currently employed operating medical and dental x-ray equipment have received formal training.

Local, state, and federal governments all have roles in protecting the public from unnecessary exposures from medical x-rays. Many programs exist, yet most are either voluntary or so poorly staffed and funded that they are not very effective. For example, the August 1981 Consumer-Patient Radiation Safety and Health Act calls on HHS to establish federal minimum standards for (a) accreditation of educational programs to train individuals to perform radiologic procedures, and for (b) certification of persons who administer radiologic

procedures. Once this model law is available, the states have three years to comply with it.

In early 1982, HHS officials met with allied health profession and consumer/health representatives to express the Department's intention of devising the standards and model law. Whether the states will adopt the federal guidelines is unclear, there are no provisions in the Act to compel the states to comply. Increased communication now -- as HHS begins developing the standards and model law -- among all the parties affected the Consumer-Patient Radiation Safety and Health Act will increase the likelihood of an acceptable and adoptable program for the states.

The FCRP will allow more effective coordination and communication among federal agencies, state agencies, and the public about existing radiation protection activities and developing additional programs. The Working Group on Protection from Exposure to Medical Radiation includes representatives of all the major constituencies affected by medical radiation regulations -- including the public -- and offers a unique opportunity to develop effective policies to protect the public from unnecessary exposures.

EPC agrees with the concept of a public health agency coordinating radiation health effects research described in Title II of S.2284. As long as the nuclear weapons industry controls its monopoly over federal funds in this research, a Federal Conference will in essence be ineffective. Instead we propose that an additional amendment be added to Title II, which reads:

"There are to be transferred to the Department of Health and Human Services all functions of the Departments of Energy and Defense to research regarding the health effects of radiation on human beings, including those functions described in Sections 31 through 33 of the Atomic Energy Act of 1954 and Sections 103 and 107 of the Energy Reorganization Act of 1974, which relate to research regarding the health effects of radiation on human beings."

In 1979, the President's Interagency Task Force on Ionizing Radiation determined that the DOE controls about 60 percent of all federal funding on the health effects of ionizing radiation. The DOE is in the business of making nuclear weapons and promoting nuclear power first and foremost. One merely has to read the Atomic Energy Act of 1954, to ascertain that these two functions constitute the principal statutory mandates of the agency.

The DOE has formed a Dose Assessment Advisory Group (DAAG) to furnish credibility to the agency's attempt to reconstruct the on-and off-site doses from the atmospheric weapons testing era. DOE's conflict-of-interest in promoting technologies it also is mandated to regulate is evident in remarks presented by Troy Wade (DOE Deputy Assistant Secretary for Defense Programs) to the DAAG:

"Even though we do have a continuing role in the current underground nuclear test program at the Test Site, we also are citizens of the State of Nevada and are just as concerned about this, about these claims, (over $2 billion in radiation damage claims filed against the government) as is everyone else."

And they wish to remain citizens of Nevada and these claims are a direct threat to their continued residence. The existence of the Test Site itself is being challenged, and as a result their jobs. At best, DAAG can only review the work that is being done. Also, they are not seeing the research which is being done by people independent of the government.

Research that may adversely affect the DOE's nuclear weapons and power promotion mandate has been subject to a well-defined pattern of suppression, harassment and intimidation of scientists who are at odds with official radiation risk estimates. This conflict continues today and is reflected in the deficiencies in the management of radiation epidemiology by the Department. Unlike the National Institutes of Health, the DOE has not followed standard contract procedures of competitive bidding, peer review and protocol in the awarding of research contracts involving the health effects of DOE-contract workers or citizens living near DOE facilities. Research contracts are given instead to institutions on the basis of personal contacts, and the ability of the DOE to ultimately control the research findings.

In 1974, the DOE decided to terminate a Research Contract held by Dr. Thomas F. Mancuso at the University of Pittsburgh. Mancuso refused to publicly attack positive findings of excess cancer observed among the Hanford nuclear workers in Washington State. He later published positive findings of his own, at which time the DOE unilaterally turned Mancuso's contract over to Oak Ridge Associated Universityes (ORAU). This contract was let without proper peer review, scientific protocol, to an organization which did not even have a principal investigator to conduct the study. Later, part of this contract was given to Battelle-Northwest under the direction of Dr. Sidney Marks. Marks, Mancuso's former DOE contract officer, orchestrated Mancuso's termination.

The Battelle contract was let without proper procedures -- the contractor had not done radiologic epidemiology work before.

The research of Oak Ridge Associated Universities and Dr. Marks is subject to litigation involving malpractice in the case of ORAU and defrauding the court in the case of Dr. Marks. ORAU is being sued for malpractice on the basis of radiation experiments involving cancer patients, who were part of a research program for NASA, to determine the radiobiologic effects of manned-space flight.

A House Subcommittee on Oversight and Investigations report shows that research co-authored by Dr. Marks was manipulated to convince a 1956 Federal Court that fallout from a 1953 nuclear weapons test did not result in the deaths of thousands of sheep grazing on nearby ranges. This suit has been reopened by the sheepmen involved in the 1956 case, and is moving forward in Federal District Court in Salt Lake City.

The credibility of the DOE in the area of health effects research can never recover from the disclosures of conflicting interests. We urge that the agency be removed from the health effects research business altogether.

This concludes my testimony, Mr. Chairman.

ATTACHMENT NO. 1

Environmental Policy Institute
317 Pennsylvania Ave. S.E. Washington, D.C. 20003
202/544-2600

ANALYSIS OF NRC DATA

ON NUCLEAR POWER PLANT WORKER EXPOSURES TO RADIATION

by Fred Millar and Bob Alvarez
September 1, 1981

Increases in Worker Exposures: "An All-Time High"

The most recent data compiled by the U.S. Nuclear Regulatory Commission (NRC) reveals an alarming increase of 33% in the average radiation exposures to the total workforce in U.S. nuclear power plants between 1979 and 1980. While the total number of commercial operating nuclear power plants in 1980 rose by only one new plant, from 67 to 68, the total worker radiation exposures for all operating nuclear plants increased from 39,759 person-rems in 1979 to 53,797 person-rems in 1980, an increase of 35%.* "The average yearly exposure for all commercial nuclear reactors," according to the latest NRC report, dated May 28, 1981, "is at an all-time high of 791 person-rems per reactor."

The big 1980 increase was no flash in the pan. Nuclear plant worker radiation doses have been rising steeply for the last three years. The 1979 average dose of 593 person-rems per reactor was itself a 20% rise from the year before. In addition, the 1979-1980 rise of 35% in total collective dose followed a similar rise of 25% between 1978-1979. The data thus provide persuasive refutation to comments by industry and NRC officials who have repeatedly suggested that some particular problem in the nuclear reactors has been given a "one-shot" fix requiring extraordinary radiation doses to workers, but that similar steep increases will not continue to occur.

NRC collects data annually from nuclear plant operators in two different ways. Data from the most recent reports show that the long-range trend in

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* When radiation doses are measured for large populations, like reactor workers, the unit person-rem is used. This measure is also used in estimating the risk of dying from radiation-induced cancer. Person-rems are derived by multiplying the total number of people exposed times their average dose in rems. Or it can be the actual sum of all doses received. For example, 10,000 person-rems is a dose received by 5,000 people exposed to 2 rems each; or by 10,000 people exposed to one rem.

U.S. nuclear reactor radiation exposures to their workforce has been a rise of 400% over ten years, from an average of less than 200 person-rems per reactor in 1969 to nearly 800 person-rems per reactor in 1980.

This high level of total worker exposures was not anticipated by those who have had to calculate the possible costs and benefits of nuclear power generation.

As we shall see below, the consequences of the large increases in terms of future cancers, deaths, and genetic damage are extremely serious. The continued exposures at unanticipated high levels confront the NRC with a clear problem in terms of its regulatory responsibility for health and safety.

The Results of Worker Radiation Exposures: Cancers, Deaths, Genetic Damage

The long-term implications of the steep rise in workers' total radiation exposure are sobering, given the recent scientific estimates on the risks of low-level radiation exposure. Even the most conservative estimates give reason for grave concern.

In the case of reactor workers a total of 53,797 person-rems were accumulated in 1980, representing a 33 percent increase over the 39,759 person-rems accumulated in 1979. The new NRC documents analyzed here do not have a breakdown of how many workers were exposed or their individual exposures.

Cancers which have been shown to be initiated by radiation include leukemia, bone marrow, pancreas, lung, large intestine, thyroid, liver and breast. Scientists' estimates of the risk of dying from radiation-induced cancer vary widely, as the table on the next page suggests.

In terms of the risk of genetic damage, the risks to workers' children and future generations are significant. According to the National Academy of Sciences BEIR I and III reports, if 50,000 person-rems accumulate each year among reactor workers for 20 years, there will be as many as 3,000 excess human heredity disorders for every 100,000 progeny. Taking these estimates further and assuming that in ten generations no intermarriage with like-damaged individuals takes place, the 50,000 person-rems of radiation would

ultimately produce as many as 1.5 million living children with heredity disorders and 4,600 recognized miscarriages in excess of the normal number.

"Used-up Workers" Outpace Electricity Production

Are the huge increases in nuclear plant worker exposures matched by increases in electricity produced? Not by a long shot. Data from an NRC study released in March 1981 (NUREG-0713) show that during the period 1969-1979, the number of U.S. operating reactors increased 950%, from 7 to 67 reactors. Total doses to workers, however, rose four times as fast, nearly 3200%, from 1247 person-rems in 1969 to 39,759 person-rems in 1979. Total electricity generated during the period did not keep pace with worker exposures; the former rose 2321%, from 1289 negawatt-years in 1969 to 29,920 megawatt-years in 1979.

Nuclear plants each have "used up" more and more radiation workers; the average number of radiation workers exposed in a single nuclear plant in 1969 was 145, whereas in 1979 the average was 1010 workers exposed, a rise of 696%.

The reported average dose for individual workers which is regulated by the NRC, has been kept well within regulatory limits, in fact has ranged from a high of 1.03 rems in 1969 to .73 rems in 1979. This level has been accomplished, however, by the using up of a total of 64,073 radiation workers in U.S. nuclear plants in 1979 compared with 744 in 1969, a rise of 8600 %. The total amount of radiation to the workforce is not regulated by the NRC or any other agency, unlike the amount of a nuclear plant's radiation releases to the environment, which is regulated by limits set by U.S. EPA.

Even so, official estimates of average radiation doses to individual workers have over time been proven seriously below the actual experience of nuclear workers. In 1972 the EPA predicted that the greatest increase in occupational radiation exposures would not be from the rapidly expanding medical applications, but from industrial uses, particularly nuclear power plants. EPA suggested that the average annual dose to individual reactor workers by the year 2000 would not exceed .225 rem. By 1979 the NRC reported the average annaul individual exposure to be .680 rems, more than three times the EPA prediction for the end of the century.

ESTIMATES OF RADIATION-INDUCED CANCER DEATHS
FOR 1980 REACTOR WORKERS*

BEIR I (1972)	2-4 cancer deaths	50-80 mil. person-rems[a]
BEIR III (1979)	3-15 cancer deaths	70-353 per mil. person-rems[a]
BEIR III (1980)	3-10 cancer deaths	77-226 per mil. person-rems[a]
UNSCEAR (1977)	5 cancer deaths	100 per mil. person-rems[b]
Radford (1981)	10-30 cancer deaths	200-600 per mil. person-rems[c]
Gofman (1977)	200 cancer deaths	3771 per mil. person-rems[d]
Morgan (1979)	350 cancer deaths	7000 per mil. person-rems[e]

* The 53,797 person-rems reported by the NRC has been rounded off to 50,000

a) National Academy of Sciences Advisory Committee on the Biological Effects of Ionizing Radiation (BEIR Committee), reports for 1972, 1979 and 1980.

b) United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) 1977.

c) Radford, E., Science, August 7, 1981.

d) Gofman, J.W., Health Physics, July 1981.

e) Morgan, K.Z., Bulletin of Atomic Scientists, September 1979. (Morgan's estimates, unlike the above, are based on the Hanford data of Mancuso, Stewart, and Kneale, published in Health Physics, November 1977).

What Explains the Recent Large Worker Radiation Exposure Increases?

There is no one answer, but some educated guesses can be made. In the first place, NRC data reveals that one major type of nuclear reactor is much hotter overall for its workers than the other major type.

Boiling-water reactors (BWRs) exposed their workforce in 1980 to nearly double the average yearly exposures compared with pressurized-water reactors (PWRs). The 1979-1980 increase in average exposures per boiling-water reactor was 55%, from 733 to 1136, while the pressurized water reactor increase was 13%, from 510 to 578 person-rems. Understanding the exposure differences requires a closer look at what is going on at the 68 operating U.S. commercial reactors: many BWRs have needed several specific major repair jobs requiring workforce exposures to many person-rems of radiation.

Some Plants Are "Hotter" Than Others: Frequent Repairs Needed

"It should be noted," stated a 1981 NRC report, "that there are significant differences in nuclear plant designs, even between plants of a given type." Some individual plants have been much "hotter" in radiation exposures (in person-rems) for their workers than others. The hottest of 30 pressurized water reactors (and their 1979/1980 exposure totals) were: San Onofre (150/2400), Surry (1800/1950), Robinson (1200/1850), Connecticut Yankee (1150/1350), Haddam Neck and Turkey Point (830/820). The hottest of 18 boiling-water reactors (and their 1979/1980 exposure totals) were: Pilgrim (1000/3650), Quad Cities (1100/2400), Millstone (1800/2160), Fitzpatrick (850/2050), Brunswick (1300/1950), and Oyster Creek (470/1730).

In all of the hottest PWRs with the exception of Connecticut Yankee, abnormally high 1979 and 1980 radiation exposures can almost certainly be attributed to the expensive, lengthy, and extraordinary inspection and repair operations required by the premature corrosion and leakage of the radioactive steam generators, a generic problem which also afflicts nearly all PWRs in the U.S. and Europe. The replacement of only one plant's failed steam generators, at the two Surry reactors in Virginia, cost hundreds of workers in 1978-79 a total of over 2000 person-rems.

The other "hottest" PWRs have undergone similar costly large scale repairs or the leaks in their extremely radioactive steam generator tubes have been frequently "plugged" at great cost in worker exposures. Recently developed remote "robot" equipment may soon be able to reduce worker exposures somewhat in the major repair jobs which many nuclear plants will eventually have to undergo, but repair techniques developed in the lab for steam generator problems have not always worked in actual on-site repair operations (e.g., tube welding in the 1980-81 San Onofre "sleeving").

Major repairs on such failed components and safety-related modifications required by NRC have clearly assumed a greater and greater importance for exposures to nuclear workers. One category of NRC worker exposure data, "Special Maintenance", accounted for only 19% of the annual collective radiation dose in 1975, but has doubled to around 40% in recent years. NRC does not, however, require nuclear utilities to submit detailed regular reports on which specific repair or maintenance jobs led to large worker exposures.

NRC officials can only guess, therefore, about what factors account for the large increases in worker radiation doses that numerous nuclear plants of both types are experiencing. The 1981 NRC report NUREG-0731 says:

> Usually, when a plant reports a large annual collective dose, and a large man-rems to megawatt-year ratio as well, it indicates that extensive maintenance or modifications were undertaken during the year. Also, numerous plants reported increases in their collective doses as a result of the actions that the NRC required operating reactors to take because of the Three Mile Island 2 accident and NRC's concern for seismic design deficiencies in safety-related piping. And again in 1978, several PWRs reported substantial collective doses associated with the inspection and repair of steam generator tubes. Some major activities at BWRs that accounted for a portion of the 1979 collective dose were inspection and maintenance of shock suppressors, and maintenance and repair of various valves.

Several NRC officials, however, report that safety-related modifications required from the "lessons learned" at Three Mile Island have not yet begun at most nuclear plants, so that these NRC requirements are not yet a significant explanation for increased worker doses. (In general, older nuclear plants are hotter for their workers because more of the reactor piping and other equipment has been irradiated during operation. But the recent

NRC data does not allow an analysis of exactly how much hotter the older plants are.)

The "ALARA" Philosophy

Without an absolute regulatory limit on total exposures to their nuclear workers, the nuclear industry is constrained only by what is termed the "ALARA" philosophy. "As low as reasonably achievable" radiation exposure to workers is the goal towards which NRC pushes the nuclear utilities. Despite ten years of nuclear reactor experience, however, the nuclear industry has not improved its ability to reduce the total worker radiation exposures measured against the amounts of electricity produced. The average ratio over the eleven-year period 1969-1979 has hovered around a level of 1.3 person-rems per megawatt-year. The 1979 figure was 1.3, up from a ten-year low in 1978 of 1.0 person-rems per reactor year. Some NRC officials say that the "more progressive" nuclear plants are compiling books on history of various repair jobs in different plants, in order to learn how worker exposures can be reduced.

The key question is obvious: what does "reasonably achievable" mean? Shielding workers from radiation can be a very expensive problem for nuclear management. The NRC has not required nuclear utilities to report how much money they are spending to reduce worker exposures to "ALARA", nor has NRC made a rule as to how much a utility is required to spend in order to reduce a given amount of such exposures. Rather than strict cost-benefit analysis, utilities use "common-sense" approaches as to what works to reduce exposures, according to NRC. NRC does not, moreover, independently monitor the accuracy of utility-reported radiation exposures, although a more vigorous NRC effort in this area is being contemplated.

A significant number of nuclear plant workers are transient workers, about 3200 each year who worked at from two to nine different nuclear facilities during 1977, 1978 and 1979. Only a small number of nuclear workers (27 in 1977, 9 in 1978, 21 in 1979) received reported exposures above the allowed quarterly limits. NRC has only "limited" data on the "career doses" of nuclear workers, since it collects data only for employees "terminating" with a nuclear

plant, not for ongoing workers.

Those NRC officials charged with maintaining worker radiation exposures "ALARA" seem to feel beleaguered by the recent onrush of high radiation-impact demands in nuclear plant operation. And the future looks grim: a NIOSH report prepared by health physicist David Scott, dated March 30, 1980, suggests that the trend of increasing person-rem exposure will be dramatic. Scott projects current trends and calculates that within the next 7 years 105,000 reactor workers may annually be receiving measurable radiation doses.

How Much Radiation, And For Whom?

Early estimates of how much total radiation nuclear plant workers would get were very low. NRC officials now report that their most recent Environmental Impact Statements for newly-licensed nuclear plants contain much higher estimates of future worker exposures, reflecting the regrettable experience of recent years.

How much total radiation exposure to a workforce should be tolerated in the centralized production of electricity? This seems to be a question no one has asked in any effective way. Nuclear plant managers report that their main question is whether they can keep the plant operating. Recent repair operations such as the Surry steam generator replacement operation, requiring hundreds of workers and record levels of total exposure (2020 person-rems for this one repair operation, despite elaborate dose-reduction techniques), seem to indicate that total worker exposures are not considered to have any foreseeable limit from the utilities' current cost-benefit perspective. A possible limit on the numbers of some skilled craftspeople might be the most compelling factor in this area.

As long as major repair operations are required for flaws in highly radioactive nuclear reactor piping and other components, "nothing much can be done" to reduce total workforce exposures to previously anticipated levels, according to NRC officials.

Finally, just one of the dilemmas in nuclear power safety is that when nuclear plants implement measures to control radiation released to the public and the environment surrounding the plant, more radioactive material is kept

inside the plant, thus to some extent shifting the radiation burden to nuclear plant workers. This is not, however, a major contributor to the workers' overall exposures, the majority of which is from increased radioactivity in permanent nuclear plant components.

Resources

Our brief analysis of occupational radiation exposures is not a comprehensive survey of the problem. The following resources contain valuable data and analysis that complement this EPI study.

NUREG - 0713, "Occupational Radiation Exposure at Commercial Nuclear Power Reactors, 1979: Annual Report." B.G. Brooks, Office of Management and Program Analysis, U.S. Nuclear Regulatory Commission. Latest in a series of annual reports including plant-by-plant data (1978 version was NUREG-0594). Available for about $5.00 from National Technical Information Service, Springfield, VA 22161.

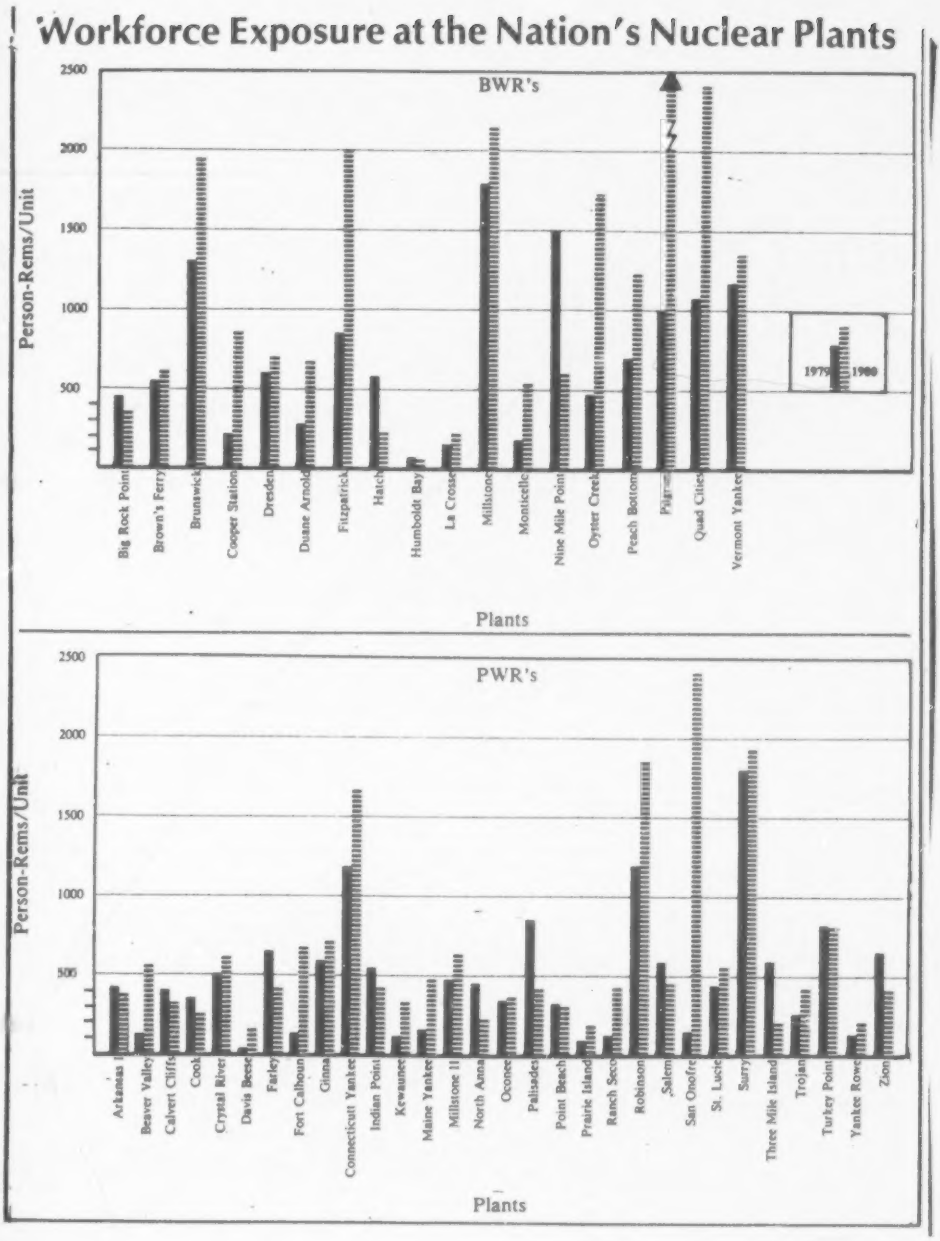
"Preliminary LWR Exposure Data for 1980", Memo from Charles Hinson, Radiological Assessment Branch to William E. Kreger, Assistant Director for Radiation Protection, U.S. Nuclear Regulatory Commission, dated May 28, 1981. 10 pp. with charts showing historical trends. Xerox available from Environmental Policy Center, 317 Pennsylvania Avenue, S.E., Washington, D.C. 20003.

"A Review of Radiation Protection Principles and Practices and the Potential for Worker Exposure to Radiation: A Research Report for the National Institute for Occupational Safety and Health", David M. Scott, Health Physicist, Rockville, Md., March 30, 1980. 122 pp. An excellent discussion, especially of the Three-Mile Island accident's implications for worker exposures. Good critique of current federal regulatory activity.

"Atomic Worker's Guide to the Most Unsafe Atomic Power Plants in 1977". Public Citizen Health Research Group, Dr. Sidney Wolfe, Dept. 411, 2000 P Street, N.W., Washington, D.C. 20036, (202)872-0320. $2.00 each. Somewhat

dated, but a valuable discussion of the overall situation which goes beyond this brief analysis. 23 pp.

"Plutonium and the Workplace: An Assessment of Health and Safety Procedures For Workers at the Kerr/McGee Plutonium Fuel Fabrication Facility," by Kitty Tucker and Elli Walters, March 1979, p. 103. A detailed analysis of utilizing official documents and worker interviews of worker health and safety at a commercial plutonium fuel fabrication facility. A timely report in the face of renewed support by the Reagan Administration for the commercial development of plutonium fuels. Available from the Environmental Policy Institute.


Workforce Exposure at the Nation's Nuclear Plants
BWR's
Person-Rems/Unit
2500
2000
1500
1000
500
1979
1980
Big Rock Point
Brown's Ferry
Brunswick
Cooper Station
Dresden
Duane Arnold
Fitzpatrick
Hatch
Humboldt Bay
La Crosse
Millstone
Monticello
Nine Mile Point
Oyster Creek
Peach Bottom
Pilgrim
Quad Cities
Vermont Yankee
Plants
PWR's
Person-Rems/Unit
2500
2000
1500
1000
500
Arkansas I
Beaver Valley
Calvert Cliffs
Cook
Crystal River
Davis Besse
Farley
Fort Calhoun
Ginna
Connecticutt Yankee
Indian Point
Kewaunee
Maine Yankee
Millstone II
North Anna
Oconee
Palisades
Point Beach
Prairie Island
Ranch Seco
Robinson
Salem
San Onofre
St. Lucie
Surry
Three Mile Island
Trojan
Turkey Point
Yankee Rowe
Zion
Plants

ATTACHMENT NO. 2

Radiation exposure limits

I am writing in regard to current activities of the Environmental Protection Agency (EPA), the Nuclear Regulatory Commission (NRC), and the Occupational Safety and Health Administration (OSHA) to revise ionizing radiation exposure limits for workers. These revisions are taking place partially in the context of the recommendations of the International Commission of Radiological Protection (ICRP) publication Number 26.

This publication recommends a series of changes eliminating loopholes in current standards, yet still allowing for very large increases in worker exposure. For example, it recommends eliminating the 5(N-18) age formula which allows workers to receive 3 rems per quarter or 12 rems whole body exposure in a given year. Also, ICRP 26 recommends integrating external with internal exposures. Currently, federal standards do not integrate the two. The present system allows a worker to receive up to 42 rems whole body and internal organ exposure in a given year (by adding the 30 rem bone and thyroid dose to the 12 rem whole body dose permitted under the 5(N-18) formula). A reduction in the 5 rem per year whole body exposure limit is not recommended, despite recent studies which suggest a 10- to 20-fold increase in cancer mortality risks at the 5 rem level.

Its recommendations on internal organ exposures are of principal concern. Under current U.S. standards, based on ICRP 2, a "critical" organ is designated and a limit is set for it. This system does not consider the possibility of radiation causing cancer in a "non-critical" organ. To deal with this problem, ICRP 26 recommends an integrated risk approach where exposure to all organs is considered through a series of "weighting factors" balancing the total risk to all organs. However, this presents a major problem which the ICRP has not discussed with the people at the highest risk. Situations where radiation is deposited in one organ alone (Strontium-90 to the bone) will mean very large increases well above current limits (see table).

The large doses implied by ICRP 26 could cause serious tissue and mutational damage leading to so-called "non-stochastic" effects (acute radiation sickness, severe organ damage and death). Realizing that these single organ doses are extremely large, the Department of Energy, in accordance with the European Economic Community and the ICRP, support a 50 rem annual limit for single organ doses. This number extended over a 30-year employment period means a cumulative dose of 1,500 rems. If this limit were accepted by the Nuclear Regulatory Commission, 23 out of 49 of their Maximum Permissible Concentrations would be raised, some by as much as 10 times. Could this be an attempt to circumvent the linear-non threshold approach that underlies current radiation standards by simultaneously using mutational and tissue damage dose/response relationships to derive radiation risks? If so, the ICRP is advocating a dangerous and misguided intrusion into regulatory practice, normally an area left to regulators, not advisory panels.

The Environmental Protection Agency, according to drafts of its proposed occupational exposure guides of August 11, 1980, supports a 30 rem single organ dose—implying a 900 rem cumulative 30-year dose. This EPA proposal would significantly raise exposures to specific radionuclides. For example, increases in lung intake from nuclides retained over days (D), weeks (W), and years (Y) include:

phosphorus-32 (D)	4.3*
phosphorus-32 (W)	1.3
manganese-54 (W)	7.5
manganese-56 (W)	10.0
cobalt-58 (Y)	4.0
strontium-89 (D)	10.0
strontium-90 (D)	17.0
zirconium-95 (Y)	2.3
niobium-95 (D)	4.0
molybdenum-99 (D)	1.1
iodine-125 (D)	4.0
iodine-131(D)	1.1
iodine-133 (D)	2.3
uranium-238 (D)	5.7
radium-226 (W)	6.7

*Factor of increase above present standards.

According to David Rosenbaum, Director of EPA's Office of Radiation Programs at a meeting before the Nuclear Regulatory Commission on January 15, 1980, suggested NRC

Organ Doses Implied by ICRP 26

	Present value of rem per year	*Values of weighting factor in ICRP 26*	*New value of rem per year*
Whole body	5	1	5
Gonads	5	0.25	20
Breast	15	0.15	32
Red marrow	5	0.12	42
Lung	15	0.12	42
Thyroid	30	0.03	167
Bone	30	0.03	167
Skin	30		
Remainder	15	0.30	17

Source: Radiations Standards and Public Health: Proceedings of a Second Congressional Seminar on Low Level Ionizing Radiation, Feb. 10, 1978, p. 13.

modifications would render the ICRP system ineffective. The EPA also supports their 30 rem limit for purposes of international uniformity.

Currently the Commission does not support any increase in organ doses and proposes an interim strategy using a hybrid of ICRP 26 and 2. ICRP 26 would be used except in circumstances where internal organ exposures would be increased. The Commission then proposes to use the ICRP 2 approach in limiting single organ exposures. The NRC would like to see further reductions implemented once their proposed interim system is accepted.

It is no secret that radiation exposures, particularly to internal organs, will have to be raised to accommodate expansion of "dirtier" technologies such as light water reactor fuel reprocessing and breeders. This is also true for nuclear trade to developing nations lacking sufficient infrastructures to implement present standards. ICRP 26 also widens the latitude for medical isotope uses beyond the estimated 8 million *in vivo* procedures given each year in the United States. Unfortunately, the European Economic Community has chosen to adopt ICRP 26 and has raised single organ exposures per year to the public and workers to 5 rem and 50 rem respectively.

Acceptance of ICRP 26 without modifications reducing single organ exposures below present limits spells out a dangerous precedent for international radiation protection progams. There is a strong need for the ICRP to undergo stringent peer review and to be made more accountable to the people for whom they make life and death decisions. This is essential since human health and financial stakes are so intertwined with the future of nuclear technologies.

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Washington, D.C.

Addendum to Testimony

by the

National Council on Radiation Protection and Measurements

on

Senate Bill S2284

Subcommittee on Energy, Nuclear
Proliferation and Government Processes

of the

Senate Committee on Governmental
Affairs

April 29, 1982

--Concerning a question by Senator Glenn on the impact of revisi
in the Hiroshima-Nagasaki dosimetry.

Revision of Dosimetry of Japanese Atomic Bomb Survivors.

One of the most important, perhaps the most important, sources of human data for the estimation of health risks from whole-body exposure to ionizing radiation is the population of survivors of the atomic bombs detonated at Hiroshima and Nagasaki in 1945. For any epidemiological study to be of value in risk estimation there must be two important features: 1) clear distinction in effects between the exposed and a control population, providing an adequate description of the effects of irradiation; and 2) a clear indication of the radiation doses to the individual(s) or organs at risk.

In Japan, as a result of the efforts of the Atomic Bomb Casualty Commission and, since 1975, of the Radiation Effects Research Foundation (a joint Japanese-American research enterprise), the statistical information on numbers and types of cancers induced in the survivors is steadily accumulating. The doses to the survivors were evaluated in a series of steps in 1950, in 1957 and in 1965. The latter effort known as the T65D (tentative 1965 dose) has been used to classify the survivors into groups according to the tissue kerma free in air to which they were exposed. Organ doses were derivable from the kerma after correction for shielding and other factors. Broadly, the T65D study found the radiations at distant points from the explosions different for the two cities, Hiroshima and Nagasaki, due to differences in the nature and design of the weapons. At Hiroshima, 20% of the kerma was due to neutrons and 80% to γ rays. At Nagasaki, only 2% of the kerma was due to neutrons. On the basis of unit total kerma, effects at Hiroshima have always exceeded those observed at Nagasaki. High values of relative biological effectiveness (RBE) for neutrons at low dose levels,

now commonly found in laboratory experiments also, have been at least one explanation offered for the difference between Hiroshima and Nagasaki.

Stimulated by some of these differences and realizing that the dosimetry was critical to any assessment of dose-effect relationship or risk, NCRP set up a Task Group in 1976 which eventually led to separate examinations of the problem in two laboratories. Loewe and Mendelsohn at Lawrence Livermore Laboratory (LLNL), and Kerr and Pace at Oak Ridge National Laboratory (ORNL), have undertaken new transport calculations, starting with a new spectrum for the Hiroshima weapon developed by Preeg (1976), which indicate that substantial revisions in the T65D may be necessary. Both laboratories conclude that the neutron dose(s) at Hiroshima should be much less (up to ~ x 10) than in T65D, and that the γ ray dose(s) should be elevated, up to x4 at the furthest distances. At Nagasaki, the changes are much smaller. The effect of these proposed revisions is essentially to remove the neutrons as a factor accounting for greater effects at Hiroshima but replace them by the increased γ ray doses at Hiroshima. Specifically, the changes would seem to bring the estimates of risk due to γ radiation at Hiroshima and Nagasaki into much better agreement than formerly and to be <u>about the same</u> as those presently used by UNSCEAR, ICRP or BEIR. Thus, eventually, the γ ray risk estimates could be on a firmer foundation than before, but what seemed to have been a human experience with neutrons may not exist now.

This matter has not yet been resolved completely. Detailed investigations, supported by DOE, of all factors and points, including spectral mock-ups, are in progress and should eventually, perhaps in 1-2

years, result in a much better understanding of the dosimetry. Only when all the proposed studies have been completed will it be possible to be definitive about the impact of the dosimetry changes on the risk estimates for x-rays. As already noted these are not anticipated to be large. Furthermore, if there had been no information from the Japanese survivors our estimates of γ ray risk, though less well founded, would not have differed greatly from present estimates.

Senator GLENN. The hearing is adjourned.

[The subcommittee adjourned at 12:12 p.m., subject to call of the Chair.]

94-649 O - 82 - 6

ADDITIONAL MATERIAL SUBMITTED FOR THE RECORD

97TH CONGRESS
2D SESSION

S. 2284

To ensure adequate protection of workers, the general public, and the environment from harmful radiation exposure, to establish mechanisms for effective coordination among the various Federal agencies involved in radiation protection activities, to develop a coordinated radiation research program, and for other purposes.

IN THE SENATE OF THE UNITED STATES

MARCH 25 (legislative day, FEBRUARY 22), 1982

Mr. GLENN introduced the following bill; which was read twice and referred to the Committee on Governmental Affairs

A BILL

To ensure adequate protection of workers, the general public, and the environment from harmful radiation exposure, to establish mechanisms for effective coordination among the various Federal agencies involved in radiation protection activities, to develop a coordinated radiation research program, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Federal Radiation Protection Management Act of 1982".

STATEMENT OF FINDINGS

SEC. 2. The Congress finds and declares that—

(1) Federal radiation protection efforts must ensure the highest practicable protection against harmful radiation exposure;

(2) the achievement of such efforts requires—

(A) the development of effective public programs designed to control necessary exposure to radiation and to eliminate unnecessary exposure to radiation as well as the implementation of control measures by private industry and other users of radiation;

(B) the coordination of activities by various Federal agencies with radiation protection responsibilities; and

(C) the development of a comprehensive and coordinated agenda for research which is designed to (i) provide risk estimates for radiation-related injuries which are more refined than existing estimates and (ii) improve understanding of radiation injury and biological repair;

(3) Federal programs in radiation research and regulation are not sufficiently coordinated;

(4) Federal radiation protection programs are sometimes marked by wasteful duplication and overlap, uncertainty concerning the extent of radiation risks,

and inadequate consideration of potentially serious hazards;

(5) in order to ensure public accountability and effective action, a central focus for Federal radiation protection programs is needed;

(6) adequate public information and education programs must be developed to ensure greater public understanding of radiation and greater public knowledge of and confidence in Federal radiation protection activities; and

(7) Federal decisionmaking procedures in the area of radiation health and safety must, where appropriate, provide meaningful opportunities for public notice and participation.

TITLE I—FEDERAL COUNCIL ON RADIATION PROTECTION

ESTABLISHMENT

SEC. 101. (a)(1) There is established a Federal Council on Radiation Protection (hereafter referred to in this title as the "Council"). The Council shall be composed of—

(A) the Secretaries of Defense, Energy, Health and Human Services, Labor, and Transportation, the Administrator of Environmental Protection, the Chairman of the Nuclear Regulatory Commission, or their designees;

(B) the Secretaries of Agriculture, Commerce, and Housing and Urban Development, the Administrator of Veterans' Affairs, and the Director of the Federal Emergency Management Agency, or their designees;

(C) one representative of the Conference of Radiation Control Program Directors; and

(D) two public members.

(2) The Director of the Office of Science and Technology Policy and the Chairman of the Federal Conference on Research into the Biological Effects of Radiation, or their designees, are authorized to attend meetings of the Council and to provide advice to the Council.

(b)(1) The public members of the Council shall be appointed by the President, by and with the advice of the Senate. The President shall appoint members to the Council who, by reason of demonstrated ability, background, training, or experience, are specially qualified to assess the policies and objectives of Federal radiation health and safety protection activities.

(2) Each public member of the Council shall be appointed for a five-year term. A public member may be removed from office by the President only for inefficiency, neglect of duty, or malfeasance in office. Any public member appointed to fill a vacancy occurring prior to the expiration of the term for which his predecessor was appointed shall be appointed

only for the remainder of such term. A public member may continue to serve after the expiration of his term until his successor has taken office, except that he may not so continue to serve for more than one year after the date on which his term would otherwise expire under this subsection.

(3) Each public member of the Council shall receive compensation at a rate equal to the daily rate prescribed for level II of the Executive Schedule under section 5313 of title 5, United States Code, for each day, including traveltime, he is engaged in the actual performance of his duties as a member of the Council, and shall be reimbursed for travel, subsistence, and other necessary expenses incurred by him in the performance of his duties.

(c) The Secretary of Health and Human Services or his designee shall be Chairman of the Council (hereafter referred to in this title as the "Chairman"). The Council shall elect a Vice Chairman from among its members. In the absence or disability of the Chairman, the Vice Chairman shall act as Chairman.

(d)(1) The Chairman shall preside at all meetings of the Council. At least six members of the Council shall constitute a quorum, but a lesser number may hold hearings.

(e)(1) Each member of the Council referred to in clauses (A), (C), and (D) of subsection (a)(1), including the Chairman,

shall be voting members. Each voting member shall have one vote on any matter before the Council.

(2) If any member of the Council referred to in clause (B) of subsection (a)(1) determines that a matter before the Council is under the jurisdiction of the department or agency represented by such member, such member may request the voting members of the Council to permit such member to vote on such matter. The voting members of the Council shall make a determination with respect to such request by majority vote.

(3) Decisions of the Council shall be determined by a majority vote of the voting members present and members referred to in paragraph (1)(B) of subsection (a) who are present and who are authorized to vote on a matter pursuant to a determination under paragraph (2) of this subsection.

FUNCTIONS OF THE COUNCIL

SEC. 102. (a) The Council shall—

(1) advise the President with respect to radiation matters directly or indirectly affecting health and safety, including regulatory guidance for all Federal agencies in the formulation of radiation standards and in the establishment and execution of programs of cooperation with States;

(2) review the authority of any Federal agency to regulate in areas concerned with—

(A) the control of radioactive materials, or processes which use such materials;

(B) equipment which generates or produces radiation;

(C) radioactive waste;

(D) nuclear powerplants:

(E) activities related to the development and testing of nuclear weapons;

(F) human radiation exposure standards; and

(G) any other activity or material which may produce human radiation exposure;

(3) on the basis of the review required under paragraph (2) of this subsection, make recommendations to the President and Congress concerning any amendments, modifications, or additions to any such authority;

(4) identify the research needed by the Federal agencies in order to effectively meet their regulatory responsibilities, and transmit to the Federal Conference on Research into the Biological Effects of Radiation a list of the research needed in the area of the assessment of human health risks from exposure to radiation;

(5) develop and recommend programs to educate the public concerning radiation health and safety;

(6) review State and local radiation control programs; and

(7) keep the Congress and the appropriate committees thereof fully and currently advised as to the activities of the Council in carrying out the provisions of this title.

(b) In carrying out its functions under this title, the Council shall consult with experts and scientists who are qualified concerning radiation matters.

WORKING GROUP ON REDUCTION AND CONTROL OF OCCUPATIONAL EXPOSURE TO RADIATION

SEC. 103. (a) At the first meeting of the Council, the Chairman shall establish, for a period of at least one year, a working group on the reduction and control of occupational exposure to radiation, which shall consist of the Secretaries of Health and Human Services and Labor, the Administrator of Environmental Protection, the Chairman of the Nuclear Regulatory Commission, or their representatives and one member of the Council appointed under section 101(b).

(b) The working group on the reduction and control of occupational exposure to radiation shall—

(1) review the need for reduction or increased control of occupational exposure to radiation, and suggest means for meeting any such need, including—

(A) reductions in any limits or standards for occupational doses of radiation permitted or recommended under any applicable law;

(B) improvements in equipment which emits radiation and which is used in various workplace environments;

(C) improvements in devices and methods for preventing, reducing, or measuring occupational exposure to radiation;

(D) improvements in the training and performance of personnel who monitor, measure, or record occupational exposures to radiation;

(E) improvements in procedures for responding to any incident in which a person receives an occupational dose of radiation exceeding any limit or standard permitted or recommended by law; and

(F) increasing the awareness of employers and employees in various occupations of the benefits, limitations, risks, and precautions related to the use of or exposure to radiation in such occupations; and

(2) study the feasibility of establishing a system for registering, preserving, and controlling records of

occupational doses of radiation received by individual workers and other occupational radiation information.

(c) In carrying out its functions, the working group on the reduction and control of occupational exposure to radiation shall consult with representatives of labor and management in occupations in which radiation exposure occurs or may occur, and with other persons who are qualified concerning occupational exposure to radiation.

WORKING GROUP ON PROTECTION FROM EXPOSURE TO MEDICAL RADIATION

SEC. 104. (a) At the first meeting of the Council, the Chairman shall establish, for a period of at least one year, a working group on protection from exposure to medical radiation, which shall consist of the Secretary of Health and Human Services, the Secretary of Defense, the Administrator of the Environmental Protection Agency, or their representatives, and the two members of the Council appointed pursuant to section 101(b).

(b) The working group on protection from exposure to medical radiation shall—

(1) review the incidence of unnecessary patient exposure to X-rays, and suggest means of reducing any such unnecessary exposure, including—

(A) high yield criteria for the selection of patients for whom referral for diagnostic X-rays is

likely to be particularly appropriate and efficacious and means for promoting the acceptance of such criteria by practitioners;

(B) appropriate performance standards for new and existing electronic equipment and systems which emit radiation to assure that patients are exposed to the minimum exposure necessary to produce the highest quality diagnostic information commensurate with the needs of practitioners;

(C) guidelines for optimum exposures in routine nonspecialty examinations needed to assure lowest patient exposure for diagnostically useful information;

(D) methods of continuously compiling lifetime patient X-ray exposure records; and

(E) quality assurance measures which will promote appropriate and efficacious use of diagnostic X-rays;

(2) suggest means to increase practitioner and patient awareness of the utility, limitations, and risks of diagnostic X-rays and of alternative diagnostic procedures, including—

(A) the development and promulgation of curricula for students of the healing arts to assure increased emphasis on the risks and utility of di-

agnostic X-rays and their appropriate and efficacious use; and

(B) recommended methods and processes, such as hospital professional standards review organizations and utilization review, to assure the appropriate and efficacious use of diagnostic X-rays; and

(3) study the use of administrative controls and reimbursement incentives to reduce unnecessary exposure to medical X-rays.

(c) The working group on protection from exposure to medical radiation shall be assisted by an advisory group, which shall be appointed by the Chairman of the Council and shall include—

(1) one individual who is a director of State radiation control programs;

(2) two individuals who represent physicians, dentists, nurses, and other health professionals, of which at least one individual shall be a radiologist or health physicist;

(3) one individual who represents the field of nuclear medicine;

(4) one individual who represents the field of radiation therapy;

(5) four individuals who represent allied health professionals;

(6) one individual who represents health care institutions;

(7) one individual who represents health professions schools;

(8) one individual who represents allied health professions schools;

(9) one individual who represents health insurers;

(10) one individual who represents manufacturers of radiologic equipment; and

(11) three individuals who represent consumers, patients, and the general public who are broadly representative of consumers of health care and who are not, and have not been, within the twelve months preceding their appointment, providers of health care.

(d) Within one year after the date on which it is established under subsection (a), the working group on protection from exposure to medical radiation shall prepare and transmit to the Council a report concerning its activities and containing any recommendations it finds appropriate.

TRANSFER OF FUNCTIONS FROM THE ENVIRONMENTAL PROTECTION AGENCY

SEC. 105. There are transferred to the Council all functions of the Administrator of Environmental Protection under section 2(a)(7) of Reorganization Plan Numbered 3 of 1970.

ADMINISTRATIVE PROVISIONS

SEC. 106. (a) The Chairman is responsible for the executive and administrative operation of the Council in carrying out the provisions of this title. The Chairman is authorized—

(1) to appoint and compensate such personnel as may be necessary in accordance with the provisions of title 5, United States Code;

(2) to employ experts and consultants in accordance with the provisions of section 3109 of such title;

(3) to utilize, with their consent, the services, equipment, personnel, information, and facilities of other Federal departments and agencies and of State, local, and private agencies and instrumentalities, with or without reimbursement therefor;

(4) to enter into agreements with other agencies as may be appropriate; and

(5) to request such information, data, and reports from any Federal agency as the Council may require and as may be produced consistent with law.

(b) Upon request of the Council, the head of each Federal agency shall promptly make the services, equipment, personnel, facilities, and information of the agency (including suggestions, estimates, and statistics) available to the Council to the greatest extent practicable.

(c)(1) The Council or, on the authorization of the Council, any subcommittee or member thereof, may, for the purpose of carrying out the provisions of this title, hold such public hearings and sit and act at such times and places, administer such oaths, and require, by subpena or otherwise, the attendance and testimony of such witnesses and the production of such books, records, correspondence, memorandums, papers, and documents as the Council or such subcommittee or member may deem advisable.

(2)(A) Subpenas shall be issued under the signature of the Chairman or any member of the Council designated by him and shall be served by any person designated by the Chairman or any members. Any member of the Council may administer oaths or affirmation to witnesses appearing before the Council.

(B) The provisions of section 1821 of title 28, United States Code, shall apply to witnesses summoned to appear at any such hearing. The per diem and mileage allowances to witnesses summoned under authority conferred by this section shall be paid from funds appropriated to the Council.

(C) Any person who willfully neglects or refuses to qualify as a witness, or to testify, or to produce any evidence in obedience to any subpena duly issued under the authority of this subsection shall be fined not more than $500, or imprisoned for not more than six months, or both. Upon the certification by the Chairman of the Council of the facts concerning any such willful disobedience by any person to the United States attorney for any judicial district in which such person resides or is found, such attorney may proceed by information for the prosecution of such person for such offense.

(d) The Council shall promulgate rules, regulations, and procedures to carry out this title.

REPORT TO THE CONGRESS

SEC. 107. Within eighteen months after the date of enactment of this Act, and annually thereafter until the Council terminates under section 108, the Council shall prepare and transmit to the Congress a report that—

(1) identifies any conflicting, overlapping, and inadequate Federal statutes and information programs concerning radiation safety and health, along with recommendations for any necessary legislative action; and

(2) sets forth a plan which—

(A) after taking into consideration the results of the reviews conducted under sections 103(b)(1) and 104(b)(1), provides for the phased reduction,

to the maximum extent and within the shortest period practicable, of occupationally related radiation exposure to workers in applicable occupations and of radiation exposure from medical and other sources to the public; and

(B) provides inducements for—

(i) the upgrading of State and local radiation control programs;

(ii) the phasing out, on an expeditious schedule, of inefficient radiologic equipment;

(iii) the establishment of standards and licensing procedures for operators of radiologic equipment; and

(iv) the establishment of standards and procedures for accreditation of institutions to train operators of radiologic equipment.

TERMINATION

SEC. 108. (a) The Council shall terminate on the day on which a reorganization plan transmitted to the Congress under subsection (b) becomes effective.

(b) Not later than July 31, 1988, the President shall prepare and transmit to the Congress a reorganization plan in accordance with the provisions of chapter 9 of title 5, United States Code, which transfers the functions of the Council to other Federal agencies. If a reorganization plan is disap-

proved in accordance with the provisions of chapter 9 of title 5, United States Code, within thirty days after the date of disapproval of such plan the President shall transmit another reorganization plan to the Congress for the transfer of the functions of the Council. The President shall continue to transmit additional plans for the transfer of such functions until a reorganization plan takes effect in accordance with the provisions of such chapter.

(c)(1) For purposes of the first sentence of section 903(b) of such title, a reorganization plan transmitted to the Congress under this section shall not be counted as one of the three plans pending before the Congress at any one time.

(2) Section 905(b) of such title does not apply to a reorganization plan transmitted to the Congress under this section.

AUTHORIZATION OF APPROPRIATIONS

SEC. 109. To carry out the provisions of this title, there are authorized to be appropriated such sums as may be necessary for fiscal year 1983 and each of the five succeeding fiscal years.

EFFECTIVE DATE

SEC. 110. This title shall take effect on October 1, 1982.

TITLE II—FEDERAL CONFERENCE ON RESEARCH INTO THE BIOLOGICAL EFFECTS OF RADIATION

ESTABLISHMENT

SEC. 201. (a)(1) There is established a Federal Conference on Research into the biological effects of radiation (hereafter referred to in this title as the "Conference"). The Conference shall be composed of—

(A) a representative of each of the Secretaries of Agriculture, Commerce, Defense, Energy, Health and Human Services, Labor, and Transportation, the Administrators of Environmental Protection, Veterans' Affairs, and the National Aeronautics and Space Administration, the Chairmen of the Consumer Product Safety Commission and the Nuclear Regulatory Commission, and the Director of the Federal Emergency Management Agency;

(B) the Director of the National Institutes of Health and the Director of the National Science Foundation, or their representatives; and

(C) two public members.

(2) In selecting a representative for membership on the Conference under clauses (A) or (B) of paragraph (1), the head of each agency shall select an officer or employee of

that agency who is involved in radiation research programs in that agency.

(3) The Director of the Office of Science and Technology Policy and a representative of the Federal Council on Radiation Protection are authorized to attend meetings of the Conference and to provide advice to the Conference.

(b)(1) The two public members of the Conference shall be appointed by the President, by and with the advice and consent of the Senate. In appointing such members, the President shall select individuals who, by reason of demonstrated ability, background, training, or experience, are specially qualified to assess the policies and objectives of Federal research programs concerning the biological effects of ionizing radiation.

(2) Each public member of the Conference shall be appointed for a five-year term. A public member may be removed from office by the President only for inefficiency, neglect of duty or malfeasance in office. Any public member appointed to fill a vacancy occuring prior to the expiration of the term for which his predecessor was appointed shall be appointed only for the remainder of such term. A public member may continue to serve after the expiration of his term until his successor has taken office, except that he may not so continue to serve for more than one year after the date on which his term would otherwise expire under this subsec-

tion. Each public member of the Conference shall serve without compensation.

(c) The Chairman of the Conference (hereafter referred to in this title as the "Chairman") shall be the Director of the National Institutes of Health or his designee. The Conference shall elect a Vice Chairman from among its members. In the absence or disability of the Chairman, the Vice Chairman shall act as Chairman.

(d) The Chairman shall preside at all meetings of the Conference. At least seven members of the Conference shall constitute a quorum, but a lesser number may hold hearings. Each member of the Conference, including the Chairman, shall have one vote. Decisions of the Conference shall be determined by a majority vote of the members present.

(e) The Director of the National Institutes of Health shall provide such support and staff to the Conference as may be necessary to assist it in carrying out its responsibilities under this title.

FUNCTIONS OF THE CONFERENCE

SEC. 202. (a) The Conference shall—

(1) advise the President with respect to Federal research activities concerned with the biological effects of radiation, including guidance for all Federal agencies in the development of such research programs;

(2) formulate an annual comprehensive Federal agenda for research into the biological effects of radiation, which shall include—

(A) an inventory of ongoing Federal programs of research into the biological effects of radiation;

(B) a review of proposed Federal programs for research into the biological effects of radiation;

(C) a strategy for research programs into the biological effects of low-level radiation, including epidemiologic studies designed to develop more accurate estimates of human risk or boundaries of risk at low-dose levels of radiation;

(D) research priorities based upon the strategy specified pursuant to clause (C) of this paragraph;

(E) recommendations for appropriate locations for the conduct of different types of research and for the allocation of resources for such research, taking into account the results of the review mandated by Congress in section 301(b)(2)(B) of the Public Health Service Act; and

(F) a discussion of data concerning human health effects of exposure to radiation needed by

Federal regulatory agencies in order to carry out their mandates;

(3) recommend to the President and to Congress—

(A) uniform standards for all Federal agencies for peer review of research into the biological effects of radiation;

(B) procedures for the dissemination of the results of such research to the public, the Federal agencies, and State and local governments;

(C) guidelines for public oversight of such research; and

(D) any transfer of research capability, including personnel and resources, between Federal agencies which is needed to implement the agenda prepared pursuant to paragraph (2) of this subsection; and

(4) assist the Federal Council on Radiation Protection in the development of programs to educate the public on radiation health and safety;

(5) keep the Congress and appropriate committees thereof fully and currently advised concerning the status of Federal activities concerned with research into biological effects of radiation.

(b) In carrying out its functions under this title, the Conference shall consult with experts and scientists who are qualified concerning radiation matters.

REVIEW OF RESEARCH REQUESTS

SEC. 203. (a)(1) Each Federal agency which conducts or provides financial assistance for studies on the human health effects of radiation shall review any proposal for such studies to determine if the studies are of sufficient scientific merit to be conducted by the agency or to be eligible for the provision of financial assistance. The agency shall transmit to the Conference any proposal for any such studies which—

(A) the agency determines to be of such merit; and

(B) will result in a total cost to the agency of more than $250,000.

For purposes of clause (B) of this subsection, in determining the total cost of studies for which the agency provides financial assistance, the agency shall include the total amount of financial assistance provided to the person conducting the studies and the cost to the agency of administering the study project.

(2) Any Federal agency may request the Conference to review any proposal for studies on the human health effects of radiation which any agency has determined to be of suffi-

cient scientific merit to be conducted by the agency or to be eligible for the provision of financial assistance.

(b)(1) Within sixty days after receipt of a proposal transmitted pursuant to subsection (a), the Conference shall review the proposal in accordance with the criteria established under subsection (c) and make recommendations to the agency which transmitted the proposal to the Conference as to whether the proposal should be approved, approved with modifications, or disapproved. The Conference may, upon notice to the agency, extend the period for review of the proposal for an additional thirty days.

(2) If the Conference does not notify the agency of its recommendations concerning a proposal within sixty days after receipt of the proposal, or if it extends the review period pursuant to paragraph (1) and does not notify the agency of its recommendations within ninety days after receipt of the proposal, the agency which transmitted the proposal shall assume that the Conference has recommended the approval of the proposal.

(c) In developing its recommendations under subsection (b), the Conference shall consider—

(1) the scientific merit of the proposed studies;

(2) the qualifications and expertise of the scientists who will conduct the studies;

(3) the resources available or to be committed for the studies;

(4) the degree to which the studies are consistent with the research agenda prepared pursuant to section 202;

(5) whether any law affects the authority of the agency to conduct or provide financial assistance for the type of studies to be performed;

(6) whether the agency conducting or providing financial assistance for the studies would be in a position of apparent conflict of interest; and

(7) any recommendations for the transfer of research capability made by the Conference pursuant to section 202(a)(3)(D).

ADMINISTRATIVE PROVISIONS

SEC. 204. (a) The Chairman is responsible for the executive and administrative operation of the Conference in carrying out the provisions of this title. The Chairman is authorized—

(1) to utilize, with their consent, the services, equipment, personnel, information, and facilities of other Federal departments and agencies and of State, local, and private agencies and instrumentalities, with or without reimbursement therefor;

(2) to enter into agreements with other Federal agencies as may be appropriate; and

(3) to request such information, data, and reports from any Federal agency as the Conference may require and as may be produced consistent with law.

(b) Upon request of the Conference, the head of each Federal agency shall promptly make the services, equipment, personnel, facilities, and information of the agency (including suggestions, estimates, and statistics) available to the Conference to the greatest extent practicable.

(c)(1) The Conference or, on the authorization of the Conference, any subcommittee or member thereof, may, for the purpose of carrying out the provisions of this title, hold such public hearings and sit and act at such times and places, administer such oaths, and require, by subpena or otherwise, the attendance and testimony of such witnesses and the production of such books, records, correspondence, memorandums, papers, and documents as the Conference or such subcommittee or member may deem advisable.

(2)(A) Subpenas shall be issued under the signature of the Chairman or any member of the Conference designated by him and shall be served by any person designated by the Chairman or any members. Any member of the Conference may administer oaths or affirmation to witnesses appearing before the Conference.

(B) The provisions of section 1821 of title 28, United States Code, shall apply to witnesses summoned to appear at any such hearing.

(C) Any person who willfully neglects or refuses to qualify as a witness, or to testify, or to produce any evidence in obedience to any subpena duly issued under the authority of this subsection shall be fined not more than $500, or imprisoned for not more than six months, or both. Upon the certification by the Chairman of the Conference of the facts concerning any such willful disobedience by any person to the United States attorney for any judicial district in which such person resides or is found, such attorney may proceed by information for the prosecution of such person for such offense.

(d) The Conference shall promulgate rules, regulations, and procedures to carry out this title.

REPORT TO THE CONGRESS

SEC. 205. Within eighteen months after the date of enactment of this Act, and annually thereafter until the Conference terminates under section 206, the Conference shall prepare and transmit to the President and Congress a report on the activities of the Conference. The report shall identify any conflicting, overlapping, and inadequate Federal research programs on radiation safety and health, along with recommendations for any necessary legislative action.

TERMINATION

SEC. 206. (a) The Conference shall terminate on the day on which a reorganization plan transmitted to the Congress under subsection (b) becomes effective.

(b) Not later than July 31, 1988, the President shall prepare and transmit to the Congress a reorganization plan in accordance with the provisions of chapter 9 of title 5, United States Code, which transfers the functions of the Conference to other Federal agencies. If a reorganization plan is disapproved in accordance with the provisions of chapter 9 of title 5, United States Code, within thirty days after the date of disapproval of such plan the President shall transmit another reorganization plan to the Congress for the transfer of the functions of the Conference. The President shall continue to transmit additional plans for the transfer of such functions until a reorganization plan takes effect in accordance with the provisions of such chapter.

(c)(1) For purposes of the first sentence of section 903(b) of such title, a reorganization plan transmitted to the Congress under this section shall not be counted as one of the three plans pending before the Congress at any one time.

(2) Section 905(b) of such title does not apply to a reorganization plan transmitted to the Congress under this section.

EXPENSES

SEC. 207. Expenses of the Conference shall be paid from funds available for administrative expenses of the Office of the Director of the National Institutes of Health.

EFFECTIVE DATE

SEC. 208. This title shall take effect on October 1, 1982.

AMERICAN DENTAL ASSOCIATION

WASHINGTON OFFICE • SUITE 1004 / 1101–17TH STREET, N.W. • WASHINGTON, D.C. 20036 • PHONE 202/833-3036

May 6, 1982

Honorable Charles Percy, Chairman
Subcommittee on Energy, Nuclear Proliferation
and Government Processes
United States Senate
Washington, D.C. 20510

Dear Senator Percy:

The American Dental Association welcomes the opportunity to comment on S. 2284, the Federal Radiation Protection Management Act of 1982, introduced by Senator Glenn. The Association requests that these remarks be included in the public hearing record on the bill.

Senator Glenn's bill would establish two bodies to coordinate federal activity in radiation protection and research. The American Dental Association appreciates Senator Glenn's concern in this area and recognizes the importance of coordinating and consolidating government programs for radiation protection. However, several provisions in the bill duplicate authority established in last year's Omnibus Reconciliation Act (P.L. 97-35) which included the Consumer-Patient Radiation Health and Safety Act.

Specifically, we object to sections 104(b)(2)(A) and 107(a)(B)(iii) and (iv) of S. 2284. These sections call for the Radiation Policy Council to develop curricula for students of the healing arts, licensing procedures for operators and standards for accreditation of institutions which train operators of radiologic equipment. These provisions of S. 2284 are virtually identical to requirements of P.L. 97-35.

The Association opposed the Consumer-Patient Radiation Health and Safety Act because it called for unprecedented federal interference in institutional accreditation and certification of dental auxiliaries -- areas already addressed satisfactorily by the states.

However, since adoption of that law, the American Dental Association and other professional organizations have been working closely with EHS officials who are writing the standards to implement the law. Moreover, P.L. 97-35 requires that these standards be promulgated by August 13 of this year. For these reasons, we question why Senator Glenn included provisions in S. 2284 which would require this process to begin all over again.

Senator Glenn has indicated on more than one occasion that the Consumer-Patient Radiation Health and Safety Act lacks incentives for states to comply. It could be inferred from his remarks that without the threat of sanctions, states will be insensitive to Congress' and the public's concerns. We do not believe this to be the case.

The Consumer-Patient Radiation Health and Safety Act calls for the Secretary of HHS to report to Congress within three years on the degree of compliance among states; if such compliance is found to be unsatisfactory, the Secretary must recommend legislative changes that would compel states to comply. We consider this provision adequate incentive for compliance. Furthermore, as additional information on radiation protection is gathered and shared, state officials will undoubtedly benefit from an increased awareness of the problem of unnecessary exposure.

Mr. Chairman, the American Dental Association appreciates and shares Senator Glenn's concerns for protecting the general public and medical and dental patients from excessive exposure to radiation. As a matter of fact, the Association's efforts to reduce unnecessary exposure predate Senator Glenn's efforts. We have long endorsed the use of high-speed film, filters and collimators to reduce exposure time and area of tissue exposed; the ADA recommends the use of lead aprons for patients, and continuing education in radiology for dentists. Furthermore, the Association recommends that x-rays not be taken routinely but only after a thorough clinical examination is conducted. However, the ultimate decision on the use of radiographs is based on the professional discretion of the dentist.

Finally, we would like to remind the subcommittee that unlike radiographic uses in medicine, dental radiographs are exclusively used for diagnostic purposes; auxiliaries who expose radiographs

such as dental hygienists and dental assistants perform many other duties in addition to taking x-rays, and supervision by a licensed dentist for all these activities is required by law in every state.

Mr. Chairman, if the subcommittee decides to approve S. 2284, the American Dental Association hopes that the subcommittee will eliminate sections 104(b)(2)(A) and 107(2)(B)(iii) and (iv) during mark-up. The professions and the government are already working together to reduce unnecessary exposure to x-radiation. Sections 104(b)(2)(A) and 107(2)(B)(iii) and (iv) of S. 2284 are redundant of existing law and are therefore unnecessary.

Sincerely,

James P. Kerrigan

James P. Kerrigan, D.D.S.
Chairman
Council on Legislation

cc: Members of the Subcommittee on Energy, Nuclear Proliferation and Government Processes

STATEMENT BY ATOMIC INDUSTRIAL FORUM'S COMMITTEE ON ENVIRONMENT BEFORE U.S. RADIATION POLICY COUNCIL

June 11, 1980

My name is Thomas W. Philbin and I am Vice President and Manager, Environmental and Resource Planning Division of Charles T. Main, Inc. and Vice Chairman of the Atomic Industrial Forum's Committee on Environment. My firm and well over 600 other domestic and foreign organizations, including electric utilities, manufacturers, architect-engineers, consulting firms, mining and milling companies, nuclear fuel service companies, financial institutions, labor organizations, universities and legal firms are members of the Atomic Industrial Forum. The Forum is an international management association interested in the peaceful uses of nuclear technology. It works to support the public's needs for nuclear energy and tries to solve and prevent problems facing the peaceful applications of nuclear energy. Toward these ends, AIF provides a forum for its member groups to arrive at a consensus on policy and technical issues.

We are extremely pleased to have the opportunity to appear before the Council so that we can present views on some of the issues that the U.S. Radiation Policy Council needs to address. We believe that the Radiation Policy Council has an extremely important role to play in formulating radiation policy for the nation and in re-establishing public confidence in our government's ability to properly regulate radiation. We fully support the Council's efforts to address the issues that need to be resolved.

In this context, I would like to review briefly several issues which we think should be high on the Council's list of priority projects:

1. There seems to be in many statements by government agencies, the Congress and in certain media reports that the only way to allay public fears about radiation is to reduce occupational and environmental radiation limits in the United States. Such an undercurrent tends to unnecessarily undermine public confidence in existing standards. These current standards were developed over a long period of time and are based on the best scientific knowledge available. There is, in fact, no scientific evidence to indicate that there is any need to reduce radiation protection limits. Please note that I make a distinction between reducing standards and the need to minimize exposures. It is a matter of principle in radiation protection that exposure be kept as low as reasonably achievable below any levels specified in the standards. Comprehensive study by the world's leading scientific bodies,

the National Council on Radiation Protection & Measurements, the National Academy of Sciences Committee on the Biological Effects of Ionizing Radiation, the International Commission on Radiological Protection, and the United Nation's Scientific Committee on the Effects of Atomic Radiation have all indicated that the current standards are indeed adequate. This preponderance of scientific judgment has been concurred in by the HEW-coordinated report of the Interagency Task Force on the Health Effects of Ionizing Radiation which was published in 1979. This report is one of the most balanced discussions of ionizing radiation ever published and has been helpful in placing the subject of ionizing radiation in better perspective. It is this perspective that the Council should seek to promote and, in doing so, to reaffirm that current standards are adequate and do provide protection and margins of safety which far exceed those used to control other environmental hazards. Radiation is probably not the least, but rather the most thoroughly understood environmental hazard and it is certainly among the most adequately regulated.

2. Our next area of concern relates to the need to better educate the public and the media about radiation and its effects especially in the context of other environmental hazards. The White House press release of February 21, 1980 indicates that the Council ". . . will stimulate information programs for the public and the media." In addition, President Carter's memorandum for the Chairman of the Radiation Policy Council also dated February 21 referred to the Interagency Task Force recommendations and the need for "programs to inform the public and specific target population about the health effects of radiation exposure, sources of radiation, and steps that can be taken to minimize exposure." The President then stated that the Council should be assured that the Task Force recommendations for developing information programs are carried out by federal agencies, and provide central coordination for federal information programs concerned with radiation.

In reviewing the fact sheet provided by the Radiation Policy Council dated May 20, 1980 which accompanied the announcement of this meeting, it is not clear to us that the subject of public and media information needs is included as a priority subject for consideration or even as a principal function. With the events of the past several years involving the radiation controversy, including that following the TMI accident, it would seem that the subject of public education should have a very high priority as the President seems to indicate. Unfortunately, radiation has been singled out among environmental hazards for special concern because of its association in the public eye with the weapons program. Unreasoned public fear over radiation, a consequence

of misinformation and ignorance, is having serious effects that are felt far beyond the direct interests of the commercial nuclear industry. It is affecting the practice of medicine, radiation diagnostics and therapy, health physics, research, and a wide range of commercial and industrial practices. This erroneous and emotionally charged view makes it extremely difficult to maintain a proper perspective on the issue. A possible solution is a coordinated public education and information program involving state, community, academic and industrial groups which properly places radiation in the context of other hazards and risks which are an integral part of our everyday lives. Only then can choices be made in the face of reason instead of emotion. We urge you, therefore, to consider public information and education a high priority project.

3. There is a growing shortage of the radiation protection personnel needed to provide the day-to-day coverage for a broad segment of the various services involving radiation required in our society. These include medical institutions, research institutions and industrial use of radioisotopes as well as the generation of power. The principal reasons for this shortage, in our opinion, is the fact that several academic institutions no longer have access to federal funding for the continuation of academic education in radiological health and the negative public perception of radiation which discourages student interest. Educational programs in radiological health were originally initiated by the Public Health Service and the Atomic Energy Commission in the 1960's but have been terminated for the most part as a result of recent federal cutbacks. The net result is an acute shortage of manpower. Thus, at a time when the need for radiation professionals is increasing, both the supply of students and suitable educational programs are diminishing.

To highlight the situation, a paper was given at our recent conference on Environmental Regulation which reviewed the growing radiation manpower problem. I am leaving with you a copy of the paper by Dr. Carl Unruh of Battelle Memorial Institute, Pacific Northwest Laboratories. The paper summarizes the situation confronting users of radiation in the U.S. It would seem appropriate for the Council to address this matter at an early date with government, academic, medical profession, and industry participation.

4. Finally, we note that the Council plans an early review of the subject of low-level radioactive wastes from medical and research institutions. We understand that this review stems from a request from the Office of Science and Technology Policy. Although we are not aware of what aspects of this problem the Council plans to explore, the reason for

examining only the medical and research waste out of context with the other types of low-level radioactive waste is not clear. We urge you to examine this subject in this broader context.

The Atomic Industrial Forum plans to submit further written comments to the Council at which time we will amplify the above brief remarks and possibly provide information on several other important issues that we believe should be of interest to the Council. We thank you for the opportunity to appear before you and present these remarks.

STATEMENT BY ATOMIC INDUSTRIAL FORUM
COMMITTEE ON ENVIRONMENT
BEFORE U.S. RADIATION POLICY COUNCIL
DECEMBER 4, 1980

My name is David Harward and I am Environmental Projects Manager for the Atomic Industrial Forum. We are pleased to present general views on several important issues that are being considered by the U.S. Radiation Policy Council for their long-term agenda as outlined in the Federal Register notice of October 21, 1980. The comments presented here represent views on these issues by members of the Subcommittee on Occupational Radiation Protection of the Forum's Committee on Environment, one of several AIF Subcommittees dealing with the subject of ionizing radiation for which I serve as secretary. This Subcommittee consits of representatives of AIF members organizations including utilities, architect-engineering firms, reactor manufactures, and organized labor.

Before commenting on the preliminary long-term agenda, there are a few remarks that would be appropriate on a specific issue not included in the long-term agenda. In the statement before the Council on June 11, 1980, we offered suggestions on several points which were considered to be of utmost importance in the development of a national radiation policy; (a) education of the public in radiation and (b) a growing shortage of radiation protection personnel. It is gratifying to note that the Council has now included the subject of public information and education as one of a series of short-term tasks. We believe this to be an important function of the Council and urge you to pursue this activity in an expeditious fashion and to make publicly available the strategy being planned to accomplish this objective. Since our presentation to the Council on June 11, the AIF has established within its Public Affairs and Information Program a Task Force on Radiation Education and Public Information chaired by Mr. John Dendahl, President, Eberline Instrument Company. This Task Force has as a principal goal, the stimulation of multi-disiplinery efforts to improve the public's knowledge of radiation and its related health effects. The Chairman of the Task Force asked me to advise you of its willingness to cooperate with the Council in this area.

The issues described in the preliminary agenda are all important subjects that should be evaluated carefully by the Council. It appears that you have identified many of the issues where government-wide coordination is especially

needed. General comments on each of the nine subject areas will be made in order of their listing in the public notice. The Council has done a commendable job in deriving the nine issues from such a large number of significant issues identified during its earlier deliberations.

1. PRINCIPLES AND CONCEPTS OF RADIATION PROTECTION

A Federal policy statement that provides guidance to agencies on implementing radiation protection principles is particularly significant when there are shared responsibilities by a number of agencies as is now the case. It is important to develop a policy that requires agencies to apply these principles and radiation protection standards on a uniform or even-handed basis when implemented. When individual agencies have the flexibility to apply basic federal radiation protection guidance in different ways, the result can be further confusion and misunderstanding on the part of the regulated and the general public, interagency disputes and possible overregulation. The policy should be developed in such a way that one agency could not be pressured into unilateral action. This problem is also addressed in the discussion of Standard-Setting Processes.

It would be a positive step to develop radiation protection policy on a basis of acceptable risk which could be developed by the existing scientific organizations. Such an acceptable risk approach could also be applied to agents other than radiation. In this connection, the development and use of the "de minimus" concept would be an important step forward in applying the principle of acceptable risk, as well as provide a basis for practical and reasonable regulation in the area of radiation protection while still maintaining public health and safety. The AIF has developed technical data on the use of the "de minimus" approach and would be pleased to make our report on the subject available to the Council, if it so desires.

2. STANDARDS-SETTING PROCESSES

In the formulation of basic radiation protection standards in the U.S., it would be beneficial to fully utilize the broad expertise of the National Council on Radiation Protection and Measurements (NCRP). This organization represents the leading U.S. body of scientific knowledge concerning the effects of radiation and their role in our national radiation standards-setting process should be clearly defined or possibly formalized. The Interagency Task Force on the Effects of Ionizing Radiation pointed out several problems associated with our current standards setting procedures, and as discussed in the Council's Federal Register notice, consistent application of radiation guidance by the several agencies involved is essential. It would be useful if current laws and executive orders involving radiation could be critically examined to determine what changes might be effective in assuring needed

consistency. This would be appropriate for inclusion in an overall examination of the radiation standards-setting process as proposed by the Council.

3. ROLES AND FUNCTIONS OF FEDERAL AGENCIES

The need for consistent application of policy and standards is clearly delineated in the Council's discussion of the roles and functions of federal agencies. In its capacity as a coordinating body, the Council has the opportunity to make a valuable contribution to the general clarification of responsibilities in this area by examining carefully these various functions and making appropriate recommendations for implementation to the President.

4. RADIATION EXPOSURE REDUCTION

A periodic review of policies and plans for reducing exposures from radiation is a desirable process to determine what practical and reasonable approaches are possible. In this connection, specific mention is made of the subject of a radiation exposure registry for transient workers. As a matter of information, the AIF is now considering a study of the feasibility of a permanent registry of transient workers in the nuclear power industry. Such a registry would be broader than radiation exposure data, however. We will be glad to keep the Council informed as this study develops if so desired.

As the AIF Subcommittee pointed out to NRC in AIF comments on the proposed revision to 10 CFR Part 20, it would be desirable for exposure limits to be established for workers in emergency situations to avoid possible regulatory problems associated with the current system. The current regulations do not permit over-exposures in emergency situations without there being a concurrent violation of the regulations.

5. DATA BASE AND METHODOLOGIES

The establishment of policies that assure an adequate, scientifically valid data base for radiation policy decisions and for public understanding should be considered as a high-priority project for the Council. Information that is scientifically valid and clearly presented should be available to the public in a consistent form and interpreted in a consistent manner. It is of utmost importance that research studies which produce the basic data on radiation health effects be subjected to adequate peer review prior to publication to avoid valuable resources being expended unnecessarily in prolonged controversy. The use of consistent methodologies for predicting radiation health effects would be an important asset in achieving consistent interpretation of the data. It would be desirable, although perhaps idealistic, to reach an agreement among the knowledgeable scientific community on the most valid methodology for the use by all concerned.

6. FEDERAL/STATE RELATIONSHIPS

States are often placed at a disadvantage with respect to their Federal counterparts since resources are not always available to meet needs in the area of radiation protection. A strong liaison with the activities of state groups, such as the Conference of State Radiation Control Program Directors, should be useful to the Council in determining where State needs are most crucial, both in the area of resources and in the application of Federally-developed standards and criteria. With the increased involvement of states in radiation protection programs, their resource needs in the area of radiological health should be assessed to determine their adequacy in terms of a national radiation policy.

One area where there is a particular need for a consistent application of radiation protection principles and standards is in the transportation of radioactive materials. Another area where state and federal coordination is vital is in the implementation of the radiation provisions of the 1977 Clean Air Act Amendments.

7. FACILITY MONITORING AND SURVEILLANCE

It is important that State agencies have the capability to carry out independent environmental radiation monitoring of radiation sources. Appropriate federal agencies often include as part of their on-going responsibilities, assistance to states in carrying out this important role. Quality assurance for radiation measurements is another important area where the Federal government can and does supply valuable assistance. An assessment by the Council of Federal/State relationships should include a review of these aspects.

8. SCIENTIFIC AND TECHNICAL PERSONNEL NEEDS

As we indicated to the Council in our June statement and in written comments, this is an important issue that needs to be evaluated on a national basis in cooperation with government agencies at all levels, the academic and research community, the medical community and industry. We are happy to see this on the preliminary long-term agenda and hope that it will be placed in a status of high-priority. The implementation of radiation protection policies and standards can only be effective if there is adequate and highly trained manpower to carry it out.

9. BUILDING CONSTRUCTION AND LAND CONTROLS

The major comment on this preliminary agenda item pertains to the siting of nuclear power facilities. As you are undoubtedly aware, the siting of facilities to be licensed by the

Nuclear Regulatory Commission is under their primary jurisdiction and a rule-making procedure is presently under way that could have a significant impact on this issue. Any supportive efforts by the Council in this area should be carried out with these factors clearly in mind. States are often involved in siting issues and their role must also be carefully considered.

In summary, it appears that the Radiation Policy Council has accurately targeted most of the important issues involved in the development of a national radiation policy. The issues are, in most instances, long-standing and will not be resolved overnight. However, the eventual resolution of the various problems associated with these issues would be a major step toward achieving practical and reasonable regulation, a goal which I am sure is mutual. The AIF Committees involved with these issues will be pleased to provide technical input to the Council during its future deliberations in these important areas.

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April 23, 1982

Senator John Glenn
204 Russell Senate Office Building
Washington, D.C. 20510

Subject: Senate Bill S.2284

Dear Senator Glenn:

Given below will be a number of comments relative to S.2284 which I would request become a part of the public record of the hearings on this bill. Because the hearing is only scheduled for a one day period, I will not presume upon the Committee to request time for an oral statement on my part.

While I have been in touch with your Committee on Previous occasions I will review, for your current attention my background, qualifications and interests in the subject bill. These will be included as Attachment No. 1.

For completeness of record, I would like to make reference to my previous testimony dated May 8, 1979 on the related Bill, S.1938, introduced in the 96th Congress. At that time you will find that I was largely supportive of the bill with what I considered to be one very important exception and I will return to that below.

It is to be noted that the stated purpose of both Bills was the same. However, the current Bill, in its body, appears to move considerably outside of the stated objectives and this causes me considerable concern. For that reason I regret that there are now a number of reasons why I feel that there are several parts of S.2284 to which objection should be put forward.

It seems to me, and to many others with whom I have discussed the problem, that the basic need for legislation today is brought about because of the uncontrolled federal proliferation of activities, interest and regulations centering around ionizing radiations. The problem has been further clouded by general public confusion between the peaceful uses of ionizing radiation in medicine and industry, the development of nuclear power and military needs. As of a couple of years ago, this resulted in the existence of some 23 Congressional committees and subcommittees, and 17 federal agencies, each having some concern with ionizing radiation. (See Attachment No. 2, pages 860-864.) It was not to be unexpected, therefore, that there should be extensive pulling and tugging between agencies and committees, and a wide variety of groups outside of the government. The problem was further exacerbated by the fact that the vast majority of the professional expertise in the fields of ionizing radiation lies outside of the federal and state government structure.

As far as radiation protection from ionizing radiation is concerned, the principal body in the United States has, for over half a century, been what is now known as the National Council on Radiation Protection and Measurements and now numbering over 500 participants. I was closely associated with that organization until my retirement, about five years ago. I now act as a free agent.

The main problem in ionizing radiation, as far as the federal governemnt is concerned, centers around the necessity for government assurance that its own activities are carried out with proper consideration for the safety of radiation workers, and the public, from radiation situations over which the federal government has control, and for which it has responsibility.

Problems brought about by the complexity of government interest in ionizing radiation, came to a head in the late 1950's, at which time the Federal Radiaiton Council was established first by Executive Order, and then Congressional action. It's primary purpose was to adopt standards necessary to assure adequate protection from radiation resulting from government activities. It must be said that on the whole, the Federal Radiation Council (FRC) was a successful operation and fulfilled the needs envisioned at the time it was first established. This situation changed when the FRC was removed from the Executive Office and its responsibilities assigned to a federal agency -- one of dozens making up the Executive Branch of the government. The basic fault in this move, made in the 1970 Reorganization Plan No. 3, was that it essentially vested, in one agency, powers or influences or whatever, over other agencies of similar political and/or organizational rank. Any such solution is obviously impractical. You can't have two dozen lieutenants, of equal rank and standing, each with his own turf to protect and each reporting to the same captain, being put in a position of reporting to one of their own number. It doesn't work in politics, it doesn't work in industry, it doesn't work in the army and it doesn't work anywhere. It was for that specific reason, and after considerable study in 1959, the Federation Radiation Council was, in principle, assigned to the White House thereby placing it at an operation level, above any of the participating agencies.

The objections to that system, in terms of overloading the White House, are understandable, up to a point. However, if the quarrelsome collection of agencies cannot be managed by any other way, that method remains open. A possible slight abridgment might be to have the Federal Radiation Council report to one of the Executive Office agencies, as for example, the Office of Science and Technology. There could be other possibilities also. The important thing is that the reporting level of the Council be a shade higher in organizational status than any one of the participating agencies. There are many who have had experience in this field who will agree, that some such solution (not necessarily the precise one) as I have noted above, is the only way in which the problem can be managed. The current bill, of course, does not consider that possibility and, therefore, in my opinion, is doomed to the same failures under which the radiation control picture has suffered in this country since 1970.

The Reorganization Plan No. 3 of 1970, placed the responsibilities that had been under the Federal Radiation Council, in the hands of the Environmental Protection Agency. This, as we now know, proved to be an unfortunate disaster. Your current bill has taken a proper step in removing such activities from the EPA.

It is possible, but not necessarily so, that your choice then being limited to some other single agency, has been the Department of Health and Human Services. This may seem an obvious choice to many, but it has some of the same difficulties as encountered through management by the EPA -- these center about the fact that HHS has strong, vested and competitive regulatory authority and interests of its own in the governmental hierarchy. This, of course, might apply to any other government agency having regulatory authority to a greater or lesser degree. It can be expected that any agency which has regulatory authority and responsibilities also has a special interest in protecting its own turf and income, as compared to agencies which do not have any regulatory responsibilities in the field of ionizing radiation. In contrast, there are a few agencies having legitimate interest and technical competence in ionizing radiation, but who have no regulatory responsibilities in the radiation field. In the array of "lieutenants" they therefore are a little "more equal" than the others. (Their serial numbers are a little lower in terms of when they became deeply involved in matters of ionizing radiation and they have no regulatory authority.)

An example would be the Department of Defense and perhaps the Department of Energy, but there are obivous political and social reasons why these would almost certainly be unacceptable to the public. Another choice might be the Department of Commerce, building its base of expertise on the interest, background and radiation experience of the National Bureau of Standards which has no regulatory authority of any kind. It might be noted that for all practical purposes, the radiaton protection standards which have been in use in this country since the early 1930's were derived through the efforts and expertise of the National Bureau of Standards during which period there was essentially no expertise in ionizing radiaton anywhere else in the government, including the health agencies. The first chairman of the FRC Working Group was from the Bureau of Standards and at a later time, NBS staff members were designated to act for the Secretary of Commerce as a member of the Federal Radiation Council itself. This was a very viable, workable and successful operation and might be considered as a reasonable alternative to having the Council management organizationally located in the Executive Office directly, or through the Office of Science and Technology.

Another matter which I think should be of deep concern to the public centers about the program of the Working Group on Protection from Exposure to Medical Radiation. It seems to me that Section 102.(a)(1) properly describes what should be the function of the Council, where it refers to "regulatory guidance for all Federal agencies in the formulation ov radiation standards and in the establishment and execution of programs of cooperation with States." Since the language does not specifically make reference to the health and safety of the public (and it should not), it is properly restricted to Federal gove2nment agency activities. And so also it would be proper for items A through G in Section 102.(a)(2), so long as these relate strictly to government activities.

Incidently, when Section 102 refers to "radiation standards" without further qualification, does it mean protection standards or all radiation standards? If the Bill is introduced to cover standards of radiation dosimetry and measurement, for example, the proposed make-up of the working groups, membership and objectives is totally inadequate. Furthermore, staff responsibility for such activities are quite inappropriate for HHS management. This is an example of a number of instances of lack of clarity in the Bill.

We then come to section 104 on Medical Radiation. In any way that I am able to read it, I see an enormous invasion by the federal government into the private practice of medicine. If this section is intended to apply only to medical irradiaton of patients in government institutions, one can not very well object. However, that is clearly not the intention of any such plans as outlined in section 104; they will call for a large and expensive bureaucracy, and additional costs for medical health care, all done on the presumption that the public is in serious jeopardy because of preconcieved and largely incorrect notions as to harmful effects of medical radiation procedures. Actually, there has been no demonstration of this in spite of the enormous amount of rhetoric on the part of a few individuals, and in a couple of government agencies. To me, this invasion of public right in this country is intolerable.

Presumably the purpose of much of this would be to provide some background information about the so-called, low-level radiation-exposure evfects. Let me point out that to acquire the kind of information for medical diagnostic x-ray examinations, that is implied in this section, will probably call for the radiation exposure records of several billion individuals, over long periods of time -- perhaps 50 to 60 years for each person -- togetxer with about an equal number ofindividuals who have not had any radiation exposure.

Intrusion of the Federal government into the matter of "selection of patients for whom referral for diagnostic x zays is likely to be particularly appropriate," is an invasion of public rights beyond anything I have ever dreamed of. The language gf some parts of that section are unclear. What is meant by "unnecessary patient exposure"? Who decides it? How do you describe it and what do you do about it, if anything? In part B, referense is made "minimum exposure necessary to produce the highest qualtiy diagnosic information": Minimum is none and highest is undefinable, so who decides what is commensurate with the need of the medical practitioners? What is meant in (C) by, "optimum exposures in routine nonspecialty examinations needed to assure lowest patient exposure for diagnosticallly useful information"? In (2)(A), there is no quesiton but that there can be inprovement in the radiation curricula for students, but I would like to know how you "assure increased emphasis on the risks and utility of diagnositc x rays and their appropriate and efficacious use "by the governmental regulatory process."

I can read Section.104.(c) to specify that of the 17-man advisory group, all but four will be drawn from federal agencies, althought this is probably not the intention (Numbers (1) and (11)). If not, and you specify, or imply, that the others are to be drawn from the private sector, the question is

immediately raised as to who selects the members of the advisory groups. Since, as already noted, the overall competence in the radition field is overwhelmingly in the private sector, selection by the government opens the door to political selection in the pejorative sense. It is also likely to be over-influenced by the manner and degree to which the media exploit their favorite name catchers. (See Attachment No. 2, page 868.) I shudder to think of a 5-man working group, having to work with a hodge podge 17-man advisory group chosen in the manner specified. It would seem to be better to encourage the working group to call upon advisors in accord with the problems in hand at any time. My experience with such statutory groups -- especially under the "sunshine" rules -- is that they are mostly used as tools to confirm what the agency wants confirmed and little else. Basically, they are mostly a waste of tax-payer's money.

I must say that in reading the section 104, I am struck by evidence of built-in prejudicial opinions, reliance on heresay and with every seeming intention of having the federal government take over the practice of medical radiology.

There are myriads of small details in other part of the bill as, for example, voting requirements, quorums, selection of members of working groups, incorrect technical language, and so on. I feel, however, that the bill is so completely untenable on the basis of section 104 that I cannot afford to spend any more time on the small details. Frankly, I am greatly disappointed that this bill not only fails to recognize the real source of the radiation problems within the government and to consider possible solutions thereto but, also, it clearly maps out a highly invasive program against the private practice of medical radiology. I had looked forward to having more constructive comments to offer. In view of the seriousness of the points which I have mentioned above -- and these are only a few -- I am afraid my position on the bill has to be relatively negative.

Nevertheless, basically, as I believe I understand the intentions of the Bill, I can support them. I feel that the management of the Council can be arranged to be outside of any single agency. There may be means to accomplish this other than those I have suggested. I base this opinion largely on my extensive experience with the FRC, and with a variety of the more usual interagency committees, most of which I would describe as "wheel-spinning" operations designed to calm some trasnient public or inter-agency pressure.

A particular imprnvement could be made by omitting much of the detail of what the working groups are required to accomplish. This would apply to the sections on both occupational and medical mxposure. The Council itself should be able to pick, choose and set priorities on the needed tasks since most of them will be of government making in the first place.

With regard to Title II, I have the impression that this part of the Government's radiaton program study is progressing reasonably well largely

because it does not involve some of the political and media pressures to which Title I is subjected. I have not examined Title II in any detail.

Sincerely Yours

Lauriston S. Taylor

LST/yb

Attachment No. 1: Biographical Sketch of L. S. Taylor
Attachment No. 2: Sievert Lecture

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ATTACHMENT NO. 1

Lauriston S. Taylor

In 1927 Lauriston S. Taylor was brought from Cornell University to the National Bureau of Standards for the specific purpose of organizing the U.S. Government's first programs in x ray standization and measurements and radiation protection. Starting a head of the x ray group he was made Chief of the x ray Section in 1941, Chief of the Atomic and Radiation Physics Division in 1951 and Associate Director of the Bureau in 1962. For over two years he was Chief of the Operations Research Section of the 9th Air Force in Europe. He spent a year as Chief of the Bio-Physics Branch of the Division of Biology and Medicine of the AEC during which time he organized the Health Physics Training Programs. In 1928 he was one of the six founders of the ICRP and in 1929 founded what became the NCRP. From 1928 he was a member and for 13 years, Chairman of the ICRU; President of the Health Physics Society in 1958. Awards and honors have included the AEC Citation and Medal as well as the gold medal of the Swedish Academy of Sciences, the Sievert Award of IRPA and gold medals of the American College of Radiology and the Radiological Society of North America.

ICRP -- International Commission on Radiological Protection

NCRP -- National Council on Radiation Protection and Measurements

ICRU -- International Commission on Radiological Units and Measurements

Vice-Chairman, Montgomery County, Maryland, Civil Defense Advisory Board, 1956-1964; Chairman of Evaluation Committee and Radiological Defense Committee

ATTACHMENT NO. 2

Health Physics Vol. 39 (December), pp. 851–874
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SOME NONSCIENTIFIC INFLUENCES ON RADIATION PROTECTION STANDARDS AND PRACTICE THE 1980 SIEVERT LECTURE*

I. INTRODUCTION

IN THE practical application of the principles for achievement of protection against harmful radiation effects, our greatest obstacles today do not include a lack of knowledge about the biomedical effects of ionizing radiation. Today, we know about all we need to know for adequate protection from ionizing radiation.

Let me repeat that. Today we know about all we need to know for adequate protection against ionizing radiation. Therefore, I find myself charged to ask: why is there a radia-

*This lecture was delivered at the Fifth International Congress of the International Radiation Protection Association, Jerusalem, Israel, 9–14 March 1980.

†Past President, National Council on Radiation Protection and Measurements.

tion problem and where does it lie? In my opinion, it falls essentially in the area of radiation control with reference to the needs and any possible risks associated with a particular use.

The inquiry will take us into considerations well beyond science; into philosophical, sociological, political, economic, and moral areas wherever questions of the uses of radiation arise. It is through its relation to these fields that the problem of controlling radiation uses becomes today so complicated.

The sociological aspects of radiation control involve the public relations, both by and within the scientific community and thence through the news community to the larger society. Further, any treatment of the societal aspects of radiation control frequently raises questions requiring political solutions, that is, actions of prudence and sagacity in devising and pursuing measures to promote public welfare. Other aspects may not be as much protecting ourselves against radiation as protecting us against ourselves (Ta57a) and from our penchant for self-torment through our obsession with health.

The control and management of any toxic agent, including radiation, requires a critical knowledge of the properties, characteristics, and biomedical effects of the agent. Furthermore, if control is to be *absolute* in the scientific sense, there must be either (1) an establishable threshold below which there is no effect or (2) the total elimination of the toxic agent.

It is obvious that as far as we know today neither of the above requirements can be met fully for ionizing radiation. Therefore, we must resort to other considerations, largely sociological, to arrive at some acceptable solution to the radiation control problem.

In developing my theme I shall mention, at least briefly, some nonscientific factors which may influence protection practices directly or indirectly and hence, in turn, influence the setting of our numerical protection standards. By and large, it is usually the needs of practice that dictate the setting of standards and the standards themselves must always represent some degree of compromise between a politic use of radiation and its elimination.

Little said today can be new or innovative, but will be designed mainly as reminders to radiation protectionists of the things that they should be aware of and be prepared to discuss in public forums. Some items need to be promoted, some discouraged, others rationalized, and still others, defended. Throughout, in relations with the public, we must avoid being patronizing and avoid any appearance of self-promotion.

Let us turn now to a brief discussion about the state of our current knowledge of the biomedical effects of ionizing radiation.

2. THE SCIENTIFIC PROBLEM OF "THRESHOLDS"

Collectively, there exists a vast array of facts and general knowledge about ionizing radiation effects on animal and man. It cannot be disputed that the depth and extent of this knowledge is unmatched by that for most of the myriads of other toxic agents known to man. It is because of this knowledge, portions of which have become known to the public, that the public has come to expect sharp, clear, definitive, and undisputed answers to any questions involving radiation. This is an understandable, if somewhat irrational, position. However, it leads to the difficulty that when there may be some indication of a lack of knowledge by, or disagreement among, scientists, the public feels that somehow they have been let down or led astray by the scientific community. A good example of this is the current so-called "controversy" within the protection community centering around the effects of radiation delivered in low doses at low dose rates. Were it not for a few congressional committees, more interested in headlines than facts, aided and abetted by a willing press and a few publicity-seeking "scientists," it is likely that the question would drone on in the normal scientific meetings and committees at a proper pace, commensurate with its importance. It's not that it is unimportant, but its priority should be low compared with so many other insults that man faces.

Ionizing radiation, delivered in sufficiently large amounts, can cause determinable effects or injuries to any biological system. However, for any particular effect observed, radiation would not necessarily

have to have been the causative agent. Practically any effect caused by radiation can occur from non-radiation causes.

Radiation effects are generally proportional to dose when delivered acutely in moderate amounts, say 100 *rads upwards, to the regions observed.* Precise proportionality is difficult to establish for the reason that radiation delivered to one part of the body may not necessarily produce any normally detected result in that area and yet have an effect on some other part of the body not necessarily exposed. However, for practical protection purposes, we postulate that for *acute* doses of radiation to any part of the body, the effect is proportionate to the dose.

There may be long latent periods between the time of exposure and the appearance of any effects that might reasonably be attributed to that exposure. Very large doses (above 500 rads) can show effects within minutes or hours. Low doses (below 50 rads) may not show any effects for periods up to several tens of years, if ever. In general, the lower the dose and the rate at which it is delivered, the longer will be the period of latency before the effect manifests itself. There is a generally inverse relationship between dose and latent period. The problem becomes especially critical in the low-dose region, say below 25 or 50 rads, *delivered acutely*, for which the latent period may be 3 to 5 decades.

During a long period any individual would be subjected to hundreds of other insults any number of which might produce the same effect as the radiation. Meaningful dose effect relationships can therefore only be obtained by highly sophisticated statistical methods. With all of our available statistical techniques of today, the number of subjects needed to show a statistically significant result one way or the other to exposure of a few rads per year runs into the millions and hence becomes impractical (We71).

Man has always lived in a radiation environment which, except for a very small increment due to weapons testing, has been essentially constant. Galactic radiation levels have changed little, except for rare but very large changes associated with reversals of the earth's magnetic field.

There is uncertainty about the existence of threshold effects for ionizing radiation; that is, dose levels above which an effect will almost certainly occur and below which it will almost certainly not. It is generally believed that there are very few threshold effects, although there are clearly some.

For the purpose of numerical protection standards, it is assumed that unless the contrary is clearly identified, any radiation will cause an effect, if not an injury. The development of a clearcut position on this question runs into complications depending upon the effects selected and how the effects are described. There are some demonstrated threshold effects in genetic dose-effect relationships. A skin erythema is definitely a threshold phenomenon. For internal body burdens of radium, there is what may be reasonably described as a "practical threshold," if not an absolute threshold. The threshold problem perhaps hinges about our ability to observe what may properly be described as an effect. It might well be that thresholds do indeed occur at exposure levels below those for which we have an observational capability. Under these circumstances, we face a situation where we cannot say with any certainty that there is or is not a threshold. This has lead to the adoption by the radiation protection community of the general postulation that thresholds do not exist and that therefore for any level of radiation, no matter how small, there may be an effect however undetectable. Here we encounter a further difficulty. If one is concerned about the degree of hazard in the region where effects cannot be found or identified, to what extent should an attempt be made to further "reduce the hazard" to some fraction of what could not be found in the first place? The question is "how large is half of something that cannot be measured?"

Dose effects are not cumulative. There must be some process of repair or recovery or replacement of cells, both of a genetic and somatic nature, if for no other reason, other than that based on modern radiation therapy techniques. It has been known for at least 50 years that the total amount of radiation delivered to a tumor and surrounding tissues can be enormously increased by the simple

expedient of introducing "rest periods" between each treatment. Without some sort of recovery phenomena in play, there could be no reasonable radiation therapy today which, of course, is not the case.

Today we know enough about dose-effect relationships to state unequivocally that at least *for low LET radiations the relationships cannot be strictly linear over the whole dose range* and that even for high doses they are probably not linear. In general, the deviation from linearity has been such as to make our radiation protection standards more conservative or more restrictive than predicted by the linear relationship alone.

The difficulty, of course, is that since we do not know the precise relationship—and perhaps it doesn't make much difference anyway—it is assumed, as a matter of cautious procedure, that the dose-effect relationships are linear throughout the entire dose range. This assumption is constantly being subjected to hard scrutiny because, if taken too literally, it leads to unnecessary and unjustifiable restrictions on the use of ionizing radiations.

In speaking of the risks attendant upon the use of ionizing radiation, we accept the conclusion that they are reasonably tangible and identifiable for high acute doses, above 200 rads. Also, it is not too far afield to say that the risk would be proportinal to the dose. But, again, in the region of protracted low doses below 25 rads, we cannot find or define effects, nor can we define risks. The concept of risk is itself basically intangible because different individuals evaluate risks differently and relate them to various intangible factors which have no definable interrelationships.

From the mere fact that radiation may cause some identifiable effect, it does not follow that the effects are necessarily detrimental. To properly speak about radiation injury, it would appear that one should only refer to an effect which, in the eyes of proper medical authorities, is regarded as detrimental in some respect (Na54). For purposes of protection against ionizing radiation, we have to deal with effects; detrimental effects; risks; quantities observable or unobservable; and so on. We have now ventured outside of the scientific arena.

3. NON-SCIENTIFIC ASPECTS OF RADIATION PROTECTION

Over the past several decades, there has been a gradually developing consciousness of the inadequacy of scientific data or reasoning that alone will lead to the establishment of unequivocal numerical radiation protection standards. In the late 1940s, it was clear to the NCRP, and probably other bodies, that non-scientific factors would be involved in establishing permissible dose standards. In 1957, I argued (Ta57b): "Radiation protection is not only a matter for science. It is a problem of philosophy, morality, and the utmost wisdom." At later times I have added "economics, politics, and public involvement" but actually they are all segments of an overall idiological approach. I shall select a few of these for special comment.

From science to the social aspects of radiation control

Let us examine some of the problems engendered by acceptance of the common assumption by radiation protectionists today that radiation effects are linearly proportional to dose from high dose (above 100 rads) down to zero dose, and there is no threshold. Absence of a threshold leads immediately to the difficulty that there is no line of demarcation between the regions where scientific evidence does or does not exist; where evidence is not found, it is simply assumed to exist—a judgmental decision. It is obvious that in reaching such a decision, a very non-scientific matter would play an important role. I refer to the emotions not only of some scientists themselves but also of the lay persons who understand only bits and pieces of the problem and who recognize that they have to depend upon the sceintist. The obvious problem is that no matter how small the dose, there may be some element of risk.

Risks expressed in so many chances per million people exposed have little meaning to the man in the street. A risk per 3 billion (world population) would yield a number 3000 times larger and by itself appear shockingly high. What is not appreciated, however, is the fact that to achieve such a risk would require exposure of the world's population to whatever dose may be considered. Somehow we

must develop a reasonable and rational explanation of radiation risk levels that can be understood by the public.

To consider some of these points, let us ask "What are the judgment elements entering into a standards setting process?" There are probably too many elements to consider a complete listing. Basically, however, the arguments would center around the degree of risk that those who were setting the standards would be willing to inflict on others or, as a part of the public, to accept for themselves.

How do you evaluate and quantitatively describe a situation, or more likely a combination of situations, each having its own set of values and its own descriptive units, and none having any unique relationship to ionizing radiation? For example, what is an effect and what is an injury and when is one not the other? Comparisons of effects and injuries have been attempted in a variety of ways, particularly in the last decade or so, and it would seem that the only comparison unit which has come to our imagination has been monetary, such as the dollar or the mark. The arguments for choosing monetary value seem at times to be frivolous, but for obvious reasons nothing better seems to have turned up. The problem becomes even more involved if one tries to evaluate, let us say, pain or mental anguish which can be two obvious "effects" that might be caused by radiation, but still short of death. Death, in fact, is probably the only endpoint which is positive and to which some kind of value can be applied.

Let us consider that risk, however we decide to describe it, is roughly proportional to radiation dose. Why are people willing to accept any risk at all? This argument applies to practically everything we do in life, with radiation being perhaps one of the smallest risks that we normally have to contend with. Do many people really plan many of their actions in terms of a risk or some kind? I doubt it. Perhaps, in a rather vague way, some individuals may think of what an action may do for them or provide for them by way of a benefit and what the consequences of a failure of the action might involve. Surely, people almost never do that in regard to driving a car, skiing, or smoking, or climbing mountains. These are well-known high risk actions.

Various radiation risk-benefit combinations complicate the setting of any acceptable risk standards (i.e. permissible dose standards). The simplest case would be when Person A takes some action where only he is at risk when he knowingly enters a marked radiation area. Then there would be an action by A where he unknowingly enters an unmarked radiation area due to negligence on the part of Person B who is not at risk. Or there may be the case where Person C is at risk while radiographing an aircraft part, the failure of which would put Person D at risk. Each of these risk situations could easily fall into a different classification scheme with consequent different numerical risk assignments and hence different permissible dose assignments. Any solution to such problems may depend more on judgment and opinion than on facts or mathematics.

For all practical purposes, it is only in the use of medical procedures involving radiation that the risk, if any, is compensated by some benefit to the person at risk. It is also the area where one is more likely to find the situation that the risk of not carrying out some action (for example, an X-ray examination) is more hazardous than any conceivable risk to an individual from the radiation.

Since risk questions do not really have discrete and scientific solutions, we are compelled to accept a philosophical approach—which I once heard described as "going wrong with confidence." What is needed, on top of our scientific knowledge, which I contend is adequate at this point, is a large supply of basic wisdom and understanding. Question: Who has it? To whom do you look for it? How far can it alone suffice to complete the problem and develop a rational action policy?

Where has the past supply of wisdom come from? Good or bad, it has come mostly from the scientists themselves, who consciously or unconsciously, recognizing the limits of their scientific knowledge, have made strong and important judgment actions regarding the amounts of radiation considered to be acceptable for radiation workers or the public or the patient. This has not been a bad thing

because, after all, the scientists involved cover a wide range of disciplines, ways of living, nationalities, ethnic backgrounds, religions, and everything else that makes for an effective melting pot. That this has been effective is evidenced by what I consider to be the fantastically fine radiation safety records that they have accomplished. No one has been identifiable injured by radiation while working within the first numerical standards set by the NCRP and then the ICRP in 1934.

Let us stop arguing about the people who are being injured by exposures to radiation at the levels far below those where any effects can be found. The fact is, the effects are not found despite over 40 years of trying to find them. The theories about people being injured have still not led to the demonstration of injury and, though considered as facts by some, must only be looked upon as figments of the imagination.

I do not argue for leaving the philosophical decision process in the hands of the scientist where, by default if nothing else, it has largely rested for the past 60 years. Nor do I argue for removing the process entirely from his hands; a combined scientific and non-scientific approach is indicated. A difficulty here is the current public attitude that if a person has worked in a field (e.g. radiation) he must be suspected of some kind of conflict of interest if he becomes involved in any related decision-making process. Actually, because of their basic training and their having to be imbued with a basic sense of objectivity, a good argument can be made that scientists, as such, are about as devoid of special interests as any group that may be found.

Aside from our experienced scientists, trained in radiation protection, where do we look further for our supply of wisdom? Personally, I feel strongly that we must turn to the much larger group of citizens generally, most of whom have to be regarded as well-meaning and sincere, but rarely well-informed about the radiation problems that they have to deal with. Nevertheless, collectively or as individuals, they can be of great value in our radiation protection domain if they can be properly guided in the technical matters without implantation of illogical and unacceptable biases and emotions and self-promotion. I will insist that we will have to utilize these people in developing our total radiation protection philosophy. This is a situation demanding a new approach to our public education process and it covers many areas of concern other than just ionizing radiation. However, as far as radiation is concerned, this is where the radiation protectionists must find and establish their roles and work at them as carefully and as diligently as they do with their monitoring, measurement, and analytical techniques.

To return to the basic philosophical question of setting standards for protection, we can, with some over-simplification, reduce the problem to two choices. One is to more or less follow the present course of theorizing that we are dealing only with a single, linear, no-threshold, dose-effect relationship. However, in doing this we must take more specific steps in the future to keep in front of the public that (!) this is only an untested theory; (2) it is used only because we don't know the precise relationship; and (3) it is probably conservative for most practical purposes. At the same time, we should stop ourselves and others from putting before the general public such niggling numbers as how many people are going to be killed by one millirem average dose from a leaky reactor (Ca79a) or 5-millirem dose given needlessly to a patient on top of the unavoidable dose of whatever you want, say, 50 millirems. Comparable annual doses are received by millions of passengers in high-flying aircraft and by the air crews who receive much larger doses; yet little concern is expressed over the situation. This is not to be construed as advocating any relaxation of our standards or the allowance of careless and sloppy radiation procedures of any kind. It is only an example of the variations in philosophical approaches to radiation hazards—real or imaginary.

On the other hand, we must find an acceptable means for stopping or counteracting the endless prattlings by a few individuals, with whatever motives they may have for keeping the public stirred up, con-

fused and alienated from the very technologists who are in the best position to properly inform and educate them (Br78b; Ta70).

A fundamental difficulty is the determination of a distinction between mischievous prattlings on the one hand and an occasional useful idea on the other. Normal "peer review" and analysis will take care of most of these situations.

The second choice in standards setting would be to follow the practices used for many decades by the toxicologists. For permissible concentrations of some toxic substance, they would set a level somewhat below that at which any effect could be found. This carried the implication of a threshold, but stopped short of saying there was a threshold. Actually, today the toxicologists are tending to adopt the linear, nonthreshold philosophy largely developed for ionizing radiations. A judicious blending of the two philosophies (and that is all they are) may well provide us with the most sensible solutions to the protection problem.

I am not suggesting anything new, but I am pointing to a basic responsibility of radiation protectionists to critically evaluate the problems and to place the facts before the world public in a manner that will assure the allayment of their fears and suspicions.

Before leaving the basic philosophical questions, there is one more item that must be considered and one which has personally worried me since the day that it was first introduced. That question relates to the system by which we have different kinds and classes of permissible exposures or dose limits for different classes of people. On technical grounds, I would not argue either as to the pragmatic need or to the acceptability of such a procedure. However, on philosophical grounds, we have problems. For example, in 1948 the NCRP had recommended a basic permissible dose for radiation workers of 0.3 r/week, and for children 0.1 of that value (Na54).

While the basic concern was centered upon a supposed greater sensitivity of children to radiation, the original purpose for a reduced permissible dose was intended to apply to the general population-at-large. This encountered objections from some members and resulted in a compromise applying the reduction factor specifically to children only.

Actually, this was done, you might say, with tongue in cheek, because it was perfectly obvious that if allowable levels for the exposure of children were set at levels less than for radiation workers, this would have to include the whole population since the two could not be separated. Indeed, that is the way it developed and gradually the differential factor of 10 became well entrenched in our numerical radiation protection standards. In fact, it was only the first of a series of numerical standards that were specified in terms of some fraction of the occupational MPD.

Technically, the differential is acceptable. It is to be expected that very few radiation workers would be permitted to receive the full 15 rems in a year, but that conceivably a much larger number of the population might be allowed to receive 1.5 rem in a year (medical plus fallout plus TV radiation, etc.). It is most unlikely that collective doses to the general population, however high on the average, would exceed the collective dose to the much smaller number of radiation workers even though a few might have annual exposures above, say, 1/3 of the MPD or 5 rem in a year.

A logical question may be asked—why should our workers be subjected to higher radiation levels than the general population? The answer is along the lines given above, but it is rarely understood that way. From a philosophical point of view, a strong argument could be made for setting the same standards for radiation workers and for the public. On the other hand, for sound pragmatic reasons, and because thus far there is no evidence of injury even to radiation workers, this would certainly introduce a tangible and unacceptable economic cost for a gain that cannot be quantitated.

Politics

The term "politics" or "political action" does not necessarily denote the association that most people have with party or national

politics. In this section, I will use politics as a word without the often disparaging meaning that goes along with it. As already noted, to be politic means to be "prudent and sagacious in devising and pursuing measures adopted to promote public welfare." (Webster.) In my use of the term, I exclude some further modifications of Webster's definition with such shades of meaning as "cunning" or "artful."

In the sense of radiation protection and in many other matters as well, political consideration really means the pragmatic combination of all of the elements bearing on a particular situation. In fact, we might almost group all of the elements which I have listed above under politics and even add some, such as legal considerations, economic considerations, social considerations, etc. In this sense, the scientist generally, and the radiation protectionist particularly, must devote more thought and attention to constructive and objective politics, including direct approaches to people through the Congress, the press, or the telecommunications media. He must develop constructive and especially objective discussions and explanations for what is happening in the field of radiation.

In the profession of politics it is unfortunate that in the United States, and probably in many other of the advanced countries, it appears that we cannot exclude what is sometimes referred to as party politics, that is, politics primarily involving the vote-soliciting actions of individuals. This relates to the more crass interpretation in the definition of politics, perhaps coming under the head of artful. From 1946 to 1977 practically all federal matters in the United States relating to ionizing radiation were handled through the Joint Committee on Atomic Energy. This was a committee operated jointly between the House and the Senate—a very special and unusual organization. It may be an over-simplification, but perhaps adequate to say that its main objective was to promote and protect the growth of the nucelar industry and to protect the public from its potentially dangerous by-products.

The Joint Committee, with a stable membership from both the House and the Senate, was dedicated to bringing out facts and an understanding of atomic energy, rather than looking for newspaper headlines and votes. The Committee, over its 30 years of existence, accumulated a massive library of technical data related to atomic energy and ionizing radiation, a major portion of which is in the public domain. To the extent possible, the Committee developed any conflicting viewpoints if each could be supported in a reasonably responsible way.

Because the actions of the Committee were focused on atomic energy operations, it was not unnatural that it promoted the uses of atomic energy in various forms, especially as applied to medicine and nuclear power. These goals eventually aroused the ire of some of the environmentalists, anti-nuclear activists, and certain key figures in the administration, with the result that the Joint Committee was ultimately abolished in 1977 by Public Law 95–110.

In its place there are some two dozen committees, many lacking in stability and without an overview power. Rarely does the chairman or staff of these committees have any knowledge in depth of the broad subject of ionizing radiation. But equally distressing is their failure to keep each other informed as to their operations and intentions. On at least two occasions I have been able to supply the staff of one committee with material from another committee of which they had not even heard. This fragmented process is wasteful, unproductive and confusing to the public. The public's confusion and misconception is further aggravated by the manner in which some of the committees will start off their hearings with testimony from individuals who are known to attract newspaper headlines but who at the same time are not regarded as particularly reliable by their professional peers (Mo78; Ta78; Br78a; Mo67a; Ma78; St78; Mo67b).

In spite of shortcomings in technical background, both federal and state legislatures can and do exert strong influences on the development of numerical radiation protection standards. However, because of the likely influence on governmental committees by vocal but prejudiced witnesses or wit-

nesses having some personal case to plead, we are today faced with the possibility of unreasonably restrictive limitations being placed on legitimate uses of ionizing radiation (Ma79; Br78; Ta70).

The media

When a scientific problem or issue enters the political arena, there is likely to be a problem of communication. There is a growing gap between many scientific developments and an understanding and appreciation of these developments by the general public or by their political representatives. Unless the scientific community is aware of this and takes measures to bridge the gaps, there may be serious difficulties. In fact, there already are.

Education of the public is not easily accomplished by the usual scientific articles and books. These must compete with the much more commonly available interpretations of controversial issues given by other media from television to comic books. This is a major problem influencing radiation control. The "news media" clearly dominate and herein lies one of the most fruitful areas in which the radiation protectionist can and must assist in the education of the public. First, however, we have to persuade the media (and I use the term rather broadly now) that they have a national obligation to assist the country in educating its public about radiation matters.

At a recent conference on this subject in Paris, I tried to point out that the education of the public in radiation matters was principally through the various news media and that the media were failing in their job. I was critical because the media insist on displaying the sensational side of any radiation story to the neglect of the facts which in most cases were far less alarming (Wa79b). I was roundly criticized for this statement by one of the representatives from the Paris paper, *LeMonde*, who insisted that the newspapers reported only the facts (Tu77).

Attacks on the news media for one reason or another are common as is their defense under the First Amendment. The First Amendment to our Constitution in the United States is an essential bulwark of freedom and is not paralleled by many other countries as far as I am aware. However, in my opinion, the First Amendment also carries with it an implied obligation on the part of the press to completely and properly report the news.

In the case of ionizing radiation which, of course, is the area with which I am most familiar, there are constant and continuous violations of this principle. The press will report and accent the news items and details which it thinks the public wants to hear about and that will help sell their papers, the latter apparently being their prime objective. The media must make money to stay alive and viable. They must sell their products and avoid wasting time on non-paying items. Thus, consciously or unconsciously, a selective process begins. The newspapers say that they are supplying what the public wants. As far as the public is concerned, they take that because it is the only thing they can get. Unfortunately, we do not have the same kind of enormous economic pressure which could keep the press in line with regard to education of the public in radiation matters—and presumably many other matters as well.

Here again I do not want to be misunderstood. As inept as our press may be in the United States in some respects, it is at least open and uncontrolled by the government—uncontrolled even to the point where it will publish such stolen government secrets as can be found. I have often wondered how the First Amendment protects the press from prosecution for the compounding of felonies (c.f. the Ellsberg Papers case).

The fact remains that we need greater responsibility on the part of the news media in the objective presentation of uneditorialized news. This requires a high degree of professional integrity. At the same time, the public wants a variety of stimulating news stories. The result is a complex of conflicting objectives—sales versus truth.

As far as radiation is concerned, our people must somehow persuade the press that it is irresponsible to subordinate radiation facts in order to stimulate sales. This will be a slow and difficult process, but any gain is worth the effort. I am not sure whether there is any

equivalent to our First Amendment in most other countries, but I am sure most of the world press presents the same difficulties for scientific understanding as coming from the American press.

Morality

What can we say in dealing with the problem of protecting people from possible adverse effects of ionizing radiation or from any other agent that might be expected to carry some risk of cancer? It must be clear from the discussions above that a slightly higher radiation exposure permitted to a group of people under a given set of conditions may cause one or two or "*n*" more injuries to that group and in reaching a decision as to what to recommend for their permissible exposure we are faced with deep moral considerations.

For example, the theoretical risk for radiation workers receiving the full MPD (5 rem/year) is ten times the risk for individuals in the public who receive the full Dose Limit (0.5 rem/year). At the same time the number of radiation workers (10^5) is only 1/2000th of that of the U.S. population (2×10^8) so that the *per capita* contribution of occupational exposure is only 1/200 the contribution of the non-occupational exposure. Such an unqualified statement by itself is just part of a simple and immoral numbers game of which we already have too many in the broad radiation protection field. (It might be remarked that only rarely does any radiation worker or any member of the public receive the normally specified MPD or Dose Limit respectively.)

An equally mischievous use of the numbers game is that of calculating the numbers of people who will die as a result of having been subjected to diagnostic X-ray procedures. An example of such calculations are those based on a literal application of the linear, non-threshold, dose-effect relationship, treating the concept as a fact rather than a theory (Mo67a). By this procedure it has been calculated that up to 30,000 deaths per year result from X-ray diagnosis and these statements are made to appear very convincing to the untrained listener. Of course, there has been no statistical or other verification of this calculation, but nevertheless the statement is so often repeated that it gains some credence among those uninformed about the fallacies involved. Unfortunately, the technique has been picked up by others (Go71; Na67). These are deeply immoral uses of our scientific knowledge.

Morality cannot be dictated by law or subjected to rule or control. Morality is almost invariably an individual matter and the best and most sincere and thoughtful of people probably have widely variant moral viewpoints on a given question. On the other hand, we cannot sweep our moral obligations under the rug, nor can we settle them or bring them into agreement by vote or edict or law. Dealing with the moral aspects of radiation protection problems demands a kind of leadership and guidance and overall understanding that is not easily found by advertising the availability of civil service positions—or any kind of position.

Laws and regulations

There is no question but that the legal, legislative, and regulatory actions in relation to radiation protection present one of our most formidable two-edged swords. On the one hand, they aid in providing a needed degree of uniformity in radiation protection procedures and they provide a base upon which action for redress can be taken as might be needed under a variety of circumstances. On the other hand, the very power behind the legal system tends to stifle initiative and innovation in many areas and invites litigation and other legal actions and greatly increases the cost of radiation, not only in industry but perhaps more importantly in medicine.

I recall attending a conference at Princeton University in the late 1950s in which one of the speakers, an attorney, gave a little anecdote which clearly foretold of things to come. He said it used to be that when a young man seeking guidance as to his life work might come to him for advice, years ago the reply would have been "Go West young man, that is the land of growing opportunity." Now, if he were asked the same question, he would reply, "Go into atomic and radiation law,

young man. That is the land of growing opportunity." He was so right.

As far as radiation matters are concerned, we cannot live without a substantial legal system to protect both industry and the public, but there are times when we wonder if the atomic energy and radiation oriented industries can survive much longer within the complex of laws and regulations that have been spun, especially over the last 10 or 15 years. A detailed discussion or even outline of the impact of the law upon radiation matters would be much too long and complicated for consideration in this paper. Instead, mention will be made of a few of the situations that as radiation protectionists we should be concerned with. Moreover, they represent examples of problems which are almost at the point of requiring some political activist type of approach on the part of the radiation protection community. I shall cite the rapid growth of federal and state bureaucracies, newly established in many instances, for the sole purpose of carrying out the requirements of radiation legislation. I shall cite the interagency rivalry in setting new numerical radiation protection standards, and finally I shall cite one of the problems growing out of workman's compensation and radiation injury litigation.

The demand and encouragement for radiation control legislation is multifaceted. For those who fear the misuse of radiation, the easy way out is to ask somebody else to regulate it. This plea may come from the man in the street, the technician, the doctor, the radiation protectionist, or the legislator. Their reasons will probably all be different.

The growth of bureaucratic involvement in radiation matters during the past two decades in the U.S. Government almost boggles the imagination. The programs may be divided into four categories. (1) Those involving radiation as a tool, such as the analysis of crystal structure or radiographic inspection of materials. (2) Research and development on radiation uses and applications, such as measurement and protection, biology and medicine, or industrial processing. (3) Regulation of the safety and uses of radiation and radioactive materials. And (4) military applications. I shall deal briefly with Numbers (2) and (3).

The first identifiable radiation program in the U.S. Government was that of the National Bureau of Standards (NBS) starting in 1913 and almost entirely devoted to measuring radium preparations for use in medicine. It was essentially a one-man effort. The first wide-range radiation program was also begun at the NBS in 1927 and was directed primarily to X-ray measurement, protection, equipment, and medical dosimetry. The radiation protection standards used in this country have been derived primarily from NBS programs.

In the middle 1930s the Public Health Service had some scattered programs having to do with the distribution of radium for medical uses and one study on diagnostic radiological apparatus. That about summed up the U.S. Government involvement in radiation matters until the start of the Manhattan District programs in the early 1940s. Post-war radiation activities were largely concentrated under the aegis of the U.S.A.E.C. and included all four categories above. Outside of that and the military R&D, the NBS was still the major radiation center in the government structure and by the mid-1950s had a staff of some 125 persons. (This is to be compared with literally thousands of persons directly or indirectly under the AEC and the military.) Without attempting to be complete as to numbers or details, let us make a listing of the more or less current government units embracing major interests in matters of ionizing radiation.

National Bureau of Standards (NBS) (Category 2)

Department of Health and Welfare (DHEW) (Categories 1, 2, 3)

Food and Drug Administration (FDA) (Categories 2, 3)

Bureau of Radiological Health (BRH) (Categories 2, 3)

National Cancer Institute (NCI) (Category 2)

National Institute of Occupational Health and Safety (NIOSH) (Category 2)

Department of Defense (DOD) (Categories 1, 2, 4)
Department of Transportation (DOT) (Category 3)
Department of State (DOS)
Department of Energy (DOE) (Category 2)
Environmental Protection Agency (EPA) (Category 3)
Nuclear Regulatory Commission (NRC) (Category 3)
Occupational Safety and Health Administration (OSHA) (Category 3)
Federal Radiation Council, 1959–1970 (FRC) (Advisory)
Council on Environmental Quality (CEQ) (Advisory)
Office of Management and Budget (OMB) (Administrative)
General Accounting Office (GAO) (Investigative)

Congressional Committees (Senate)
Commerce, Science, and Transportation
Subcommittee, Science, Technology, and space
Subcommittee, Labor, Health, Education, and Welfare
Energy and Natural Resources
Subcommittee, Energy Production and Supply
Subcommittee, Energy Research and Development
Environment and Public Works
Subcommittee, Environmental Pollution
Subcommittee, Nuclear Regulation
Finance
Subcommittee, Energy and Foundations
Subcommittee, Health
Governmental Affairs
Subcommittee, Energy, Nuclear Proliferation and Federal Services
Human Resources
Subcommittee, Health and Scientific Research
Subcommittee, Labor

Congressional Committees (House of Representatives)
Education and Labor
Subcommittee, Compensation, Health, and Safety
Government Operations
Subcommittee, Environment, Energy, and Natural Resources
Interior and Insular Affairs
Subcommittee, Energy and the Environment
Interstate and Foreign Commerce
Subcommittee, Consumer Protection and Finance
Subcommittee, Health and the Environment
Subcommittee, Energy and Power
Science and Technology
Subcommittee, Advanced Energy Technologies and Energy Conservation, Research, Development, and Demonstration
Subcommittee, Space Science, Research, and Technology
Subcommittee, Fossil and Nuclear Energy Development and Demonstration
Ad Hoc Committee on Energy
Armed Services
Subcommittee, Intelligence and Military Application of Nuclear Energy
Environmental Study Conference

There is no assurance that these lists are either complete or that all units mentioned are active at any one time.

With perhaps 17 agencies and some 24 congressional committees, each vying for its piece of the budgetary pie or prestige with its constituents, is it any wonder that there is competition, overlap, and confusion in the radiation regulatory field? The wonder is that there is not more. An excellent example of recent vintage was the struggle for leadership in the development of radiation protection standards, primarily between the EPA and NRC, but with DOE and BRH anxiously watching from the wings. This led to the so-called "Libassi Study" of all radiation matters in the government (Li79). A remarkably fine report was produced, including organizational recommendations made to the President. However, the retiring Secretary of HEW, in presenting them to the President, recommended such modifications as to dilute and vitiate the principal objectives of the study (Ca79b). In the meantime, the EPA continues (with the concurrence of NRC?) to try to make its imprint on the radiation

world by setting new radiation exposure standards at levels on the order of 10% of man's unavoidable exposure (to natural and medical radiation).

The Kemeney Report to the President on the Three Mile Island incident directs attention to ".... a preoccupation with regulations" by the NRC. It goes on "... we are convinced that regulations alone cannot assure safety. Indeed, once regulations become as voluminous and complex as those regulations now in place, they can serve as a negative factor in nuclear safety." And later it states "... the nature of some of the regulations .... may in some instances have served as a deterrent for utilities or their suppliers to take the initiative in proposing measures for improved safety." (Ke79; Po79c.)

This observation fits closely to my own reasoning as to why regulatory protection standards should not be derived on the basis of keeping the exposure of radiation workers (or the public) "as low as practicable" (ALAP). Use of that principle, which cannot be considered as scientifically or technically based, should be reserved to allow for the very initiative and innovation which is barred by specific numerical regulations (Ta72).

The implications arising from the attempted use of the "least practicable" concept in regulations are now a cause of concern. It is generally accepted that laws or regulations should be uniform in their application to all within their jurisdiction. Indeed, this is one of the prime virtues of laws or regulations. The "low as practicable" concept, however, has merit precisely because it allows deviation from the radiation protection standards which are, indeed, designed to be applicable to all. The attempt to specify by regulation what is "least practicable" appears to be an unfortunate melding of concepts which vitiates the merits on each side. It undoes the assured uniformity of regulations because deviation on a case-by-case basis would appear essential, and yet removes from those subject to the regulation the responsibility for ascertaining what need be done to meet the "least practicable" criteria.

Application of the ALAP principle should be primarily a political-management action presumably designed to promote the public welfare. But is it? Surely not, if it impedes independent initiative and innovation.

(On the question of initiative and innovation, an interesting statement of USSR philosophy is expressed in a paper presented to the ICRP in 1972 by A. A. Moiseev. He stated, "Today radiation protection in our country is governed by a fairly large number of regulations. So sometimes they say that the basic principle of legislation in the field of radiation protection is 'everything which is not specifically permitted is prohibited'." I doubt that this is official policy, but it does reflect an attitude toward, or result of, complex regulations.)

The establishment of a regulatory program for radiation—or anything else—is always accompanied by a far-reaching action and continuing activities. Let us develop a scenario for what happens.

To have regulatory authority, it is first necessary to have radiation legislation. Of course, the next step is to develop a pattern of regulations and that requires a few people on some public payroll. The problem then is that no radiation legislation and regulatory body ever stood still. They seem to have to grow and before long there is a new organization box in some bureau under a section chief, with an assistant section chief, an administrative aide, and even a few workers. The next obvious step is to have a new Bureau.

However, the Division or the Bureau, having once completed the job for which it was established, will find itself with nothing to do and, of course, this is never allowed to happen; new jobs are sought to replace completed ones. The basic principle in bureaucracy is that it either expands or it dies. It cannot even stand still, so we are soon caught in a web of increasingly complex and restrictive regulations, further removing from commerce and putting into the government those actions which were once designed to promote initiative, innovation, and most effective use of our scientific and technical blessings, whatever they may be.

In a country such as the United States, or a group of countries as in the European

Economic Community, any central government finds that however massive its bureaucracy may be, it needs help from lower governmental echelons and so there are almost immediate steps taken to set up a structure of state controls, state regulations, state organizations, state bureaucracies. But in states, you cannot have a small bureaucracy. It must be some critical size even if it be only ten or twelve people. Multiply this by 50, in our case, and a new kind of problem arises. How are these organizations going to be staffed? Where are the people coming from? Where are they getting their training? We are now in the big employment and big money business. While I believe I might personally prefer the concentration of such effort to be at the state level, I can recognize many problems—states' rights, inspection power, policing power, court power, uniformity or nonuniformity of standards, susceptibility to local pressure groups—each demands its own little bureaucracy. I have not even mentioned the fact that in many of our major cities we again run through the duplicative process with a new set of variants. These variants are apt to come about through the normal tendency of individuals or organizations to put their own imprint on whatever regulatory pattern they may have inherited or had passed down from above. There have been some nearly disastrous examples of new and inexperienced radiation control groups who felt the need to improve on the recommendations that had already stood the tests of time and experience. It is a tendency against which warning must be issued.

It is natural, to be expected, and to a certain extent, productive that within a short time we have informal organizational ties between the national and state controls, and between the state and city control groups. It makes for very convenient political communication when Washington wants to expand its program or is fighting off some budget-conscious appropriations committee. There is immediate communication with the state counterparts who know what to do and who are in a position to bombard their elected representatives at the federal level with whatever pleas might fit the situation. There is nothing unique or sinister about the way most free governments work and, I might add, it works the other way, too—the help from Washington can be sought either individually or collectively by the states. The picture needs no further painting. What is needed is a conscience and a consciousness on the part of the users of radiation and those who work with it. They should recognize that if this type of situation is allowed to develop in uncontrolled fashion, they and their objectives in the field of health and safety will become one of the endangered species, if for no other reason than a lack of money.

Unless we do something to control our appetite for legislation and regulation in practically every field in this country, we are going to be in real trouble. At this point, I happen to be speaking about medico-legal problems, but I should mention a commonly-heard phrase in the U.S., and probably everywhere else, "If you have a problem, make a law." What is not said is that we will primarily be contributing to a legal paradise—for someone else.

Another difficulty involving legislation relates to health, safety, and medical care from the cradle to the grave. A point of interest here has to do with Workman's Compensation in the nuclear or radiation industry. (Let me hasten to add that I personally believe in Workman's Compensation as a legitimate charge against industry.) In the U.S. we are having a gradual increase in the number of "radiation injury" compensation cases settled in favor of the worker, usually by compensation boards, but also by the various courts. Most of these cases center around individuals who have had very low doses in the course of their radiation work, but who have developed malignancies. Of the cases that have come to my attention so far, most have incurred a lifetime exposure of not more than 5 or 10 rads acquired over a period of several years.

A malignancy may, as we know very well, be caused by radiation, although on the basis of our knowledge of dose-effect relationship, the likelihood would be extremely remote at the levels mentioned. By whatever route, many of the cases are settled in favor of the

plaintiff in spite of evidence in some cases that the particular type of cancer that developed had never been known to result from an identifiable radiation exposure.

The problem here is not that settlement for the plaintiff is necessarily reprehensible, but rather, by our judicial system, precedents are set for future cases. The courts are settling by law scientific questions that cannot be resolved by science. By legal edict they are "establishing" dose-effect relationships which are contrary to the best scientific observations that we have today.

Litigation in some of the cases has been extremely expensive and some of the settlements outrageous and unreasonable. See, for instance the "Silkwood Case" (Si79). On occasions I have said, sometimes seriously and sometimes facetiously, that it would be less expensive and perhaps more humane if it were decided that any time a person who had worked at any time during his life with radiation and subsequently developed a cancer which might be ascribed to radiation at any level, he be given free treatment, together with what would be a normal compensation for the family. With all of our national health plans in being or in prospect, this would scarcely add a drop in the bucket to overall health care in this country.

Economics

The possible influence of economics on the standards for radiation protection must be so obvious that it scarcely needs mentioning. There is constant pressure on the part of some radiation protectionists as well as "consumer advocates" and generally concerned members of the public to further increase the stringency of our radiation protection standards. Too often, their arguments are based mainly on the theoretical estimates of effects that have never been observed and in turn on calculations of deaths or cancers due to specific sources of radiation exposure.

However, the meeting of whatever numerical standard that may be promulgated is directly amenable to well established scientific, engineering, and manufacturing evaluation and planning. Essentially any degree of protection can be achieved—at a cost. The problem is to evaluate the risk, the cost of reducing it, and the gains to be achieved. The process is frequently referred to as "balancing the risk against the benefit." The principle is so simple as to be disarming. The difficulty lies in the quantitative elusiveness of both risks and benefits.

Consider a couple of examples. It was once proposed that leakage radiation from a deep therapy X-ray tube be reduced by a factor of 2, such that the nonuseful radiation striking a patient will drop from 1% to 1/2% of the level in the useful beam. First, one might consider the common sense of the action. How important is it to eliminate 25 rads of stray radiation in comparison with a therapeutic dose of 5000 rads to a person who is already suffering from cancer? It might be noted also that relatively rarely will it be possible to administer that large a dose with an accuracy better than ± 100 rads.

If one still wished to reduce the stray radiation, it could be accomplished in a straightforward way simply by adding lead around the tube. This might require a slight redesign of the encasement but this is easily costed. What is somehow overlooked is illustrated by the fact that by increasing the weight of the tube enclosure, the weight of the counter balances must also be increased and in turn this could require redesign of the stanchions holding the equipment. (One half value layer for 400 kV is 2.5 mm of lead; we are talking about several hundred pounds.) It is even conceivable that under some circumstances the overall increase in weight of a piece of equipment might require structural changes in the room because of the floor loading. It can be done and the cost can be assessed, but of course this extra cost is one of the many that are passed on to the consuming public.

In the case of power reactors, the economics would be much more difficult to evaluate. Were it thought necessary to further reduce the radiation passing through the containment system by a factor of 2 or 5, a whole new kind of chain reaction of costs would be involved. Where the different radiation levels from a particular reactor are known, they are likely already to be too low to evaluate except in terms of *assumed risk*

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by such theorizing as has already been discussed. So this is a case of reducing by a factor of 5 something that you did not know in the first place. There has to be some point below which further reductions are unjustifiable. This would call for the recognition of a *de minimis* level for radiation below which it would cease to be a matter of concern. It might be pointed out that if someone today were to decide on a reasonable *de minimis* level for radiation exposure, it would probably be found that most of our radiation installations are already well below it (Ad75).

Today we think in terms of balancing risk against benefit by some means, however vague and indefinite but, as already noted, there is no way to make a positive evaluation of risk at the low dose and dose-rate levels commonly encountered in medicine and industry under normal conditions.

By adhering to the theory of a linear, no-threshold dose effect relationship, risk comparisons can be made between effects at high doses where we do have information and those at low doses where we have no information. The numerical values of these risks are possibly basically without meaning, but are at least internally consistent and so evaluation of the costs of increasing or decreasing protection in a given installation can be made in terms of the arbitrary risk numbers. In practical application, this would be useful to the extent that it helps meet what someone has set as a risk goal, whether or not he knows what it really means.

A different kind of economic problem arises in connection with regulatory operations. In the process of defending, say, a budget request, a federal agency will work up an elaborate cost-benefit tree designed to show how, by a certain addition to their facilities or program, they can save so much radiation exposure per person averaged over the public. This, in turn, will reduce the risk to the public and hence reduce the number of radiation effects. But the bottom line is to show that these imaginary effects will reduce hospitalization and Medicare, so that there is an overall saving to the taxpayer. I've seen at least one example where an agency showed a particular saving for a given program and someone on the outside, by using precisely the same input information, showed—by what appeared to be equal logic—that it would make a much more costly program over all.

I'm afraid that any attempt at evaluation of real economics of radiation in general or of radiation protection in particular must remain very subjective and be so based on individual opinion as to be impractical for most purposes. There are many factors on both sides of the question such as outlined above where the radiation protectionist can and should play an intelligent and productive role, at the same time avoiding the biases and partisan aspects of the situation.

4. POSSIBLE CORRECTIVE ACTIONS NEEDED

Education

In the development of an overall understanding and acceptance of radiation as one of man's most invaluable tools, we need two things: (1) a better communication within and between scientific and technical groups on the one hand and the general public on the other; and (2) much broader education of and dissemination of information to the public. Perhaps a third item should be added. These communication and educational projects should be carried out basically by non-governmental organizations, aided and assisted, however, by some government support.

Communication is an essential part of education. The problem here is, first, to develop an adequate level of respect and confidence each for the other. In the fairly recent past, there was a high level of respect, confidence, and pride on the part of the general public for science and the scientist generally. For a variety of reasons, this has been seriously eroded within the past few years to the point where there is now some occasional outright distrust of the radiation scientist (Re79; Bu79). I will argue that this is basically undeserved and yet that some of the reasons for the distrust are fairly clear and must be corrected in the future.

As far as the public is concerned, there has been an aura of mystery—almost of mysticism—about radiation and for reasons, some

valid and some not, the public has come to realize that it has on occasion been told untruths or part truths about some radiation matters, primarily by government agencies. As far as government responsibility in these affairs has been concerned, it can probably be argued that at the time information was concealed or distorted, there were considered to be acceptable political or economic reasons to warrant it. In a time of international threats, ventures in Asia, subversions at home, problems in Iran, I believe a good case can be made for some of the misinformation that may have been supplied to the public. In the present period, I do not visualize any such reasons for current concealment, but at the same time it is next to impossible to go back and correct most of the earlier mistakes.

I suggest the futility of trying to correct the mistakes of the past. The important thing now is to minimize the making of any further mistakes. If further mistakes surface, as some surely will, we should acknowledge them, explain, and correct them to the best of our ability; and, above all, bring an end to this dangerous game of sueing today for every conceivable honest mistake made by the parents of yesterday. To repair the communication situation requires a much greater effort on the part of scientific, technical, and governmental communities to at least identify and to the extent possible isolate the small handful of prophets of doom who supply the media and the public generally with partial or deliberately deceptive information about radiation matters. I cannot offer a solution to this problem. Condemnation of one individual in this country has been attempted and while he no longer has any credibility among his professional colleagues, the public is not so informed and he is still given a public platform on which to stand and peddle his shoddy wares (He71).

In the matter of communication, the radiation protection profession must play a major role, together with coordinated and concerted effort by several other nationally and internationally recognized organizations having long familiarity and responsibilities with problems of radiation and protection measurements. This is not the place to try to outline the technique for accomplishing this.

Let us return for a few moments to the role of the news media in radiation protection matters. (I will hereafter simply refer to it as the media.) I have already referred to the 1977 Paris conference entitled "A Colloquium on the Psycho-Sociological Implications of the Development of the Nuclear Industry." This colloquim was designed to try to identify and focus attention on some of the social and psychological aspects of dealing with the overall problems, not just of radiation, but of the whole nuclear industry. It was clear from many of the discussions that inadequate education of the public was basically the cause for much of the public concern, distrust, and misunderstanding of the overall nuclear problem (Tu77).

It is my belief that much of the blame for the public's fears and apprehensions with respect to radiation matters are due to our media—newspapers, magazines, radio, and television. No particular one is better or worse than the other. The difficulty here is that, of the general public, only an exceedingly small fraction of what we sometimes refer to as the better educated people have the willingness and capability to absorb and evaluate the burgeoning information concerning the nuclear industry generally and radiation hazards specifically. Where do people get their information? Primarily, it is from the press and, in my opinion, the press is failing in its unwritten responsibility under its Constitutional freedoms (Se79). Let us make one simple fact clear before continuing. The media are in existence primarily to make a profit under our free enterprise system. At the same time, the media enjoy special protection under at least our First Amendment in the gathering and dissemination of information, not to mention their editorial treatment, which is not news but opinion. We must not take any action which could conceivably destroy this basic freedom. But perhaps we should seriously consider some restrictions and/or penalties for responsibility failures. For example, let us require that in reporting a news event, the media report it all as it occurs, not only that segment that is in line with their publication policy. Mistakes in

observation will be made; these are excusable. Mistakes, however, of selecting only certain aspects of a news item and suppressing others is a general, but totally unacceptable practice.

I have a practice of "calibrating" a newspaper or radio station or magazine. In reading about situations with which I might be familiar in some detail, I judge the integrity of the particular medium by the degree to which it reports or slants or editorializes a particular news item. If I find unreliable or biased reporting on something about which I know a great deal, I have to assume that this will apply to everything else in that particular source.

I must add that this procedure is not a comforting one because it develops that hardly any one of the media that I have encountered has what I would consider a reasonable aura of reliability and authenticity. When I complain about this, as I do frequently, I am told that the only solution is to read a variety of the newspapers or magazines. In the first place, this is impractical for busy people. In the second place, it is interesting to find that there is not that much difference between comparable media and you sometimes wonder why. I think I know the reason why, and I have been told this directly by more than one publisher or editor. The answer to this is that they are interested only in publishing material that they believe will promote the sale of their wares. However iniquitous this may seem, a certain amount of it has to be accepted because the alternatives would be government controlled and supported media which totally reflect the policies of the government. That would be intolerable! Can we reconcile ourselves then to the fact that a free press can survive only if it makes a profit. What has happened in those countries where people believed you could have limitless freedom without responsibility?

Insofar as radiation is concerned, it would be an interesting, noble, and possibly critical experiment for the various media over a period of several years to report clearly, sharply, and correctly only that information which is verified. At the same time they should avoid editorializing, guessing for hidden meanings, or making technical interpretations which, smart as the well-trained reporters may be, they and their editors are not in position to do properly. If the media would so limit their courage, an enormous amount of help from trained and responsible radiation protectionists would be required—and I am certain can be had for the asking. But however high a level of integrity there might be among those chosen to help, there would still be a need for a technical oversight program to ensure their objectivity and absence of bias. As I say, it would be a noble experiment. I dare some responsible news medium to undertake it for some reasonable period of perhaps several years. If such an experiment was in any degree successful, all of the media would have to comply; and then, as far as radiation is concerned, we would find ourselves in a new kind of radiation conscious world.

The U.S. Six

There is yet another, if related, criticism that must be directed to the media, namely, their constant use of a small number of individuals who are clearly out of step with the radiation protection community. In the U.S. alone there are some 3500 health physicists and 1800 radiological physicists. The National Council on Radiation Protection and Measurements has, over the years, utilized over 550 scientists covering every professional field having any conceivable bearing on radiation protection standards and yet the media will, for some newly breaking news story, seek out some of a half dozen individuals who are willing to make wilfully deceptive statements regarding radiation. Collectively they account for more news lines than the hundreds of reliable professionals accepted by their peers. (I refer to them as the U.S. Six.) If the media want to improve their professional image, they must studiously avoid the sensationalism produced by the U.S. Six, but which they presently believe sells their wares.

The U.S. Six has a strange mixture of talents. One or two still have some degree of professional reputation left and, as self-protection from their colleagues, they will carefully hedge their statements. At the same time,

however, their statements are interlaced with enough of the usual fear catchwords which are often the only part captured by the reporter inexperienced in the nuances in matters of radiation protection. The others are mainly individuals who have been rejected by their colleagues and seem indifferent to their loss of professional acceptance which has been replaced by media acceptance.

They are a difficult group to deal with because they make such unexpected and scientifically unsupportable statements. Any professional who tries to respond to them quickly finds that the statement becomes modified and he finds himself struggling against a "moving target." Even worse, he cannot shoot at that target with the same ammunition used by the other person. The provocateur no longer has a substantial reputation at stake by making outrageous statements, whereas if the individual who may be debating with him makes a single transgression from the accepted fact, he is disparaged and criticized by his colleagues. This small group of individuals are well known in the radiation protection and other scientific communities.

Scare books and articles

Let us turn briefly to one other means of communication and education not normally included under the heading of media. That is the writing and publication of books to be sold individually over the counter. I have a small collection of "popular" books published over the last decade or so dealing with radiation matters. There is not a single one which is not riddled with half-truths, untruths, and evidence of basic lack of knowledge of the subject (see list following references). The one common item that all of the books have is a high level of sensationalism and an eye-catching title or subtitles. These books are written mostly by individuals who have no basic background knowledge of nuclear energy or radiation. They can write equally authoritatively about vegetable soup, ionizing radiation, or travel in India, in quantity and at a profit.

Unfortunately, many people—and especially those who are sincerely concerned about many of our present-day problems in the nuclear field—read these books and believe that they read the facts. This happens simply because they do not know enough about the subject to recognize much or any of the guileful and misleading statements.

I have talked to young people who have read several of these books and when I try to explain their unreliability, they come back with "Not only is it this author but it is that author and that author and they all agree on the same thing." Here you encounter an immediate difficulty when you try to explain the truth, namely, that these particular writers largely feed on each other. The authors cannot go to reliable technical sources because they cannot understand them even if they exist in reasonably popular form—and there are unfortunately very few of those. Why? You know the answer. The answer is that they cannot be sold in adequate quantity and at a profit because they cannot be objective and sensational at the same time.

The books that I have been speaking about have largely been written with a profit motive. There are occasional others, such as a pair of books written by Gofman and Tamplin, individuals who have a substantial scientific background and radiation experience. Their books are obviously written to support their opposition to nuclear power, government research support policies, and so on. In spite of being written by one-time scientists, their books carry all of the sensationalism of the media. They undoubtedly sell well and are read by many people who are in no position to exercise any critical judgment as to the authenticity of their claims. Their arguments for lowering radiation protection standards have been repudiated by the National Academy of Sciences and failed of adoption by the ICRP and NCRP (Be72).

Before leaving this part of my discussion, I invite attention to one of the insidious practices designed to keep the public alarmed about radiation matters. This is the constant linkage made between the atomic bomb and any discussion about radiation, even including medical applications. In spite of the fact that man has lived in an environment of radiation since his beginning and since we

have had in the world acceptable standards for radiation protection many years before atomic energy, as we think of it today, was "discovered," there was little public awareness of these facts and essentially no public concern except in isolated situations about radiation injuries and radiation uses. Until about the mid-1920s the only people being noticeably injured by radiation were physicians who used radiation in their medical practices. Unless protection for them could be provided, they might have had to give up all use of radiation for medical purposes, a situation which was clearly recognized as a world disaster and totally unacceptable. Patients were rarely injured and the public essentially never injured. Numerical protection standards were developed nationally and internationally in the early 1930s and, as pointed out above, for individuals working within these standards there has never been a directly identified case of injury. The same standards were used by the Manhattan District in the development and construction of the first nuclear weapon. It is a fact that of all of the heavy industry we know of today, the nuclear industry has had one of the best overall safety records.

Without going into detail, general public awareness of radiation came first with the destruction of the two Japanese cities. There was concern about military uses of atomic weapons, but there was little concern about radiation as it might affect our own safety. The situation changed rapidly with the detonation of large weapons in the 1950s and the recognition that fallout from these weapons could reach every person in the world. It was that situation which irrevocably engendered the fear, the consternation, and apprehension about radiation which we have today, a fear on the part of a generally uninformed public. Those of us who had worked with ionizing radiation for 25 or 50 years knew it could be coped with and are living examples of the fact. Of my many colleagues in this field the world over, I do not know of any who have died of what might in any way be ascribed to their exposure to radiation which, in several cases, has amounted to hundreds of rads over several years. We work with the stuff, we fear the stuff, but we control the stuff. The problem is to convince the public of these facts and further that radiation can be adequately controlled as far as they are concerned. However, this goal is not even going to be approached until we do something with the common fault of all of the media and most of the books that are available to the public.

In a television documentary presentation on ionizing radiation or a news story about some small accident in a nuclear installation, or a large or small accident in a nuclear power plant, practically the first thing that is presented to the reader or the viewer is a story about a bomb, a picture of a bomb exploding, reference to radiation through the term "fall-out," and so on *ad nauseam*. These are the catchwords. Why should a discussion about radiation protection problems in the medical industry be preceded by some statement or picture of a bomb? (Wt79). Why should some story about exposure of radiation inspectors in an aircraft factory make reference to a bomb? More understandable, but equally preposterous, is why should an article about a nuclear reactor accident such as the TMI case always be preceded by some reference to the bomb or an explosion and fallout, the standard warfare terms, when the public has been informed by good and reliable sources that a power reactor simply cannot explode like a bomb. It was amazing how rapidly the hydrogen bubble was described in bomb terms. Radiation measured up in the air was described as "fall-out." It was known by those who understood the problem that the hydrogen bubble was not a bomb—it was admittedly a problem but it was also known that the gas would readsorb and disappear safely. It was known by those who understood that even under the worst conceivable situation, namely a loss of control (commonly called a meltdown) this was not going to be something like a bomb, nor was it going to burn a hole through to China—hopefully, only to Hollywood. It was also known that in spite of all manner of mistakes, poor judgement, poor planning, or whatever you wish, the Three Mile Island reactor had enough protective redundancy built into the system so that it did as was expected and shut itself down. There is no question but

that it was a serious accident, but no one was killed or even injured by falling off a scaffold somewhere, but was this the way it was reported in the press? Hardly!

The most direct and honest reason for that kind of reporting was given by an article in the *Washington Post* from which I quote (Po79a):

> "The press, no matter its nationality, thrives on red meat. Red meat is disaster, tragedy, conflict—wars, assassinations, Jonestown massacre, exploding coal mines.
>
> "The Three Mile Island nuclear accident was red meat, of a sort never before experienced by the press; all the fine fibre of a Delmonico. It was a story of technology run amok, man forced from his home by the peaceful atom, the prospect of a stretch of the eastern seaboard being turned into an irradiated wasteland."

Credibility of scientists

I've already mentioned that one of the difficulties against which we must work today in providing better public communication and education is to somehow restore the credibility of scientists. Scientists are scientists and that's their karma. But as I've already emphasized, they are also human beings, citizens, come from families, and have families. Therefore, scientists make mistakes of judgment and of fact as do all of us.

In some respects, the scientist stands apart from most other individuals who can be placed in some definable pattern. In the first place, the average scientist starting in research is not very likely to have financial gain as his prime objective. He does have to earn enough to live in reasonable comfort, have some freedom from financial worries, and to have a family life. For the true researcher, the man at the bench, the highest real reward is in terms of a professional reputation, acceptance among his colleagues, his reputed objectivity, and his reputed intellectual honesty. If he fails in any one of these elements, he is destroyed. Of such people, then, why should the media and the public always be seeking some ulterior motive in whatever the scientists do or say?

A scientist, having selected some challenging field which interests him, tries to read all of the literature pertinent to his problem, carefully identifying those portions which are theory or postulation and those which are strongly or weakly supported by experimental evidence or facts. Upon digesting this, he then maps out a course of action, but one thing a scientist never does is to start out with a pre-conceived idea of what the final results will be.

Many times when a particular goal is not reached, something else of importance is; or he may be testing to see if some theoretical concept is borne out experimentally, but again the final result is not preconceived. Some of the critical scientific discoveries that have come about in the past have not agreed with theory and the theories had to be changed. The scientist's professional reputation comes from reporting exactly what he finds, no matter what it may seem or where it may lead. No pressures can force him to report something which he did not find. Unless he is willing to risk a loss of his professional reputation, no scientist is likely to be suborned by the people or organizations that support him and make his work possible. It would be, of course, ridiculous to assume that the whole body of scientists engaged in a field such as nuclear physics would enter into a mass betrayal of their professional standards.

In recent times we have witnessed many attacks or accusations against the work of scientists, primarily by the press, and usually by individuals not having scientific or technical backgrounds themselves. Great play has been given to the disagreement between some scientists either as individuals or as part of some scientific groups. This is pictured as being chaotic, self-serving, a cover-up, or such. Actually, it is normal, proper, and healthy intercourse of scientists and means only one thing—the data they have to work with are incomplete and may be even unobtainable within our known capabilities. The research is still incomplete; there are conflicting interpretations of the same or different results. In other words, they are not yet ready to achieve the one overall acceptable solution to the problem and no amount of public

screaming, accusations, Congressional hearings, editorials, letters to the editor, laws or regulations, or what-not will force a solution.

CONCLUSIONS

I plead that we cease the seemingly endless procession of studies, committees, and hearings on the problem of "low level ionizing radiation," just to choose one of the problems that plagues us today. About this, we know what we know and we know what we do not know; there is reasonable and rational agreement as to the degree of disagreement. We know that the full and final solution to the dose-effect relationship for low doses (less than, say, 5 or even 10 rads) delivered at any dose rate, is not in sight and will not be attainable within any of the capabilities that can be visualized today. There are sound and agreed technical reasons for this statement. But, and most importantly, we also know that regardless of the precise relationship between the effect and doses below, say 5 rads, whatever the effects may be, they are miniscule if they exist at all; and they cannot be identified as radiation effects among all the other similar effects that occur due to otherwise unidentified sources.

So where does this leave us? Either we forget the whole "problem" or we theorize or postulate a dose-effect relationship. The latter has, in fact, been done for the past two decades or more, and is used by radiation protection scientists as a theoretical upper limit to the theoretical effects.

However, this is what has led to our present dilemma because of the fact that our technical verification has boundaries of limitation. The limitation has been grasped (even if not understood) by some Congressional Committees, by some government agencies, and by the public. Each, in different ways, has interpreted and treated the theoretical estimates as if they were experimentally established facts rather than as the scientific speculations and provisional pragmatic solutions which they are. Thus has been opened the door to wildly imaginative statements as to what may be happening at the low doses where no effects can be found. Perhaps in hindsight it might have been better had the radiation protectionists not brought this miniscule monster out of their closet—but it is out of the closet and the world is alarmed. So now it is up to the scientist to find the most practical solution to our dilemma—but he will need the assistance of the same public and media which have been his prime attackers.

For the failures of the public to recognize the situation outlined above, we are forced, in part, to blame the media. Although the scientific community is not without blame of its own, at least the responsible part of the protection community has not presented deliberately distorted facts and hidden meanings to the press or to anyone else.

As already noted, whether recognized or not, the press in dealing with our protection problems lends favor to charlatans—individuals who know how to make headlines and become known to the public as "the authorities."

The media seem firmly to believe that this sort of sensationalism is essential to their survival; they fail to appreciate that they must work hard for the real freedoms under which they operate and they must recognize the obligations entailed by the protection of that freedom. Most crucial among their obligations is their collective duty to help educate the conglomerate public to keep our nation a strong nation. Also, the radiation protectionist must learn to work hand-in-hand with the media—the two cannot stand aloof from each other.

Regardless of anything else we do at all levels of government and society, the media have, for all practical purposes, been designated by our Constitution as the guardian and promoter of communication for the general education of the public.

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